PROPOSED
TOTAL MAXIMUM DAILY LOAD (TMDL)

For

Siltation & Habitat Alteration

In The

Upper Elk River Watershed (HUC 06030003)

Bedford, Coffee, Franklin, Giles, Grundy, Lincoln, Marshall,

and Moore County, Tennessee

DRAFT

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LIST OF ABBREVIATIONS

ARS	Agricultural Research Station
BMP	Best Management Practices
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CRC	Cumberland River Compact
DEM	Digital Elevation Model
DWPC	Division of Water Pollution Control
EPA	Environmental Protection Agency
HRWA	Upper Elk River Watershed Association
HUC	Hydrologic Unit Code
LA	Load Allocation
MGD	Million Gallons per Day
MOS	Margin of Safety
MRLC	Multi-Resolution Land Characteristic
MS4	Municipal Separate Storm Sewer System
NED	National Elevation Dataset
NPS	Nonpoint Source
NPDES	National Pollutant Discharge Elimination System
NSL	National Sediment Laboratory
Rf3	Reach File v.3
RM	River Mile
STATSGO	State Soil and Geographic Database
SSURGO	Soil Survey Geographic Database
TDEC	Tennessee Department of Environment & Conservation
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation
WCS	Watershed Characterization System
WLA	Waste Load Allocation
WMD	Water Management Division
WWTF	Wastewater Treatment Facility

SUMMARY SHEET

UPPER ELK RIVER WATERSHED (HUC 06030003)

Total Maximum Daily Load for Siltation / Habitat Alteration in Waterbodies Identified on the State of Tennessee's 1998 303(d) List or the Proposed Final 2002 303(d) List

Impaired Waterbody Information:

State: Tennessee
Counties: Bedford, Coffee, Franklin, Giles, Grundy, Lincoln, Marshall & Moore
Watershed: Upper Elk River (HUC 06030003)
Watershed Area: 1396 mi^2
Constituent of Concern: Siltation / Habitat Alteration
Impaired Waterbodies:

	Waterbody ID	Waterbody	RM
1998 303(d) List:	06030003006	Coldwater Creek	48.5
	06030003027	Dry Creek	24.8
	06030003053	Rock Creek	10.8
	06030003065	Indian Creek	45.3
	060300030850.7	Childer Creek	8.9
Proposed Final 2002 303(d) List:	06030003012_0400	Robinson Creek	23.0
	06030003032_1000	Wagner Creek	18.8
	06030003041_0100	Yellow Branch	7.1
	06030003044_0100	Betsy Willis Creek	22.5
	06030003044_0200	Patton Creek	4.2
	06030003051_0200	Blue Spring Creek	13.0
	06030003053_2000	Rock Creek	16.1
	06030003056_0300	East Fork Mulberry Creek	16.8
	06030003085_1000	Childer Creek	8.9
	06030003552_1000	Gum Creek	12.9
	06030003567_1000	Hessey Branch	9.6

Designated Uses: Fish & aquatic life, irrigation, livestock watering & wildlife, and recreation. Some waterbodies in watershed also classified for domestic and/or industrial water supply.

Applicable Water Quality Standard: Most stringent narrative criteria applicable to fish & aquatic life use classification:

The waters shall not be modified through the addition of pollutants or through physical alteration to the extent that the diversity and/or productivity of aquatic biota within the receiving waters are substantially decreased or adversely affected, except as allowed under 1200-4-3-.06. The condition of biological communities will be measured by use of metrices suggested in guidance such as Rapid Bioassessment Protocols for Use in Streams and Rivers (EPA/444/4-89-001) or other scientifically defensible methods. Effects to biological populations will be measured by comparisons to upstream conditions or to appropriately selected reference sites in the same ecoregion.

TMDL Development

Analysis Methodology:

- Watershed Characterization System Sediment Tool (based on Universal Soil Loss Equation) applied to subwatershed areas corresponding 12-digit hydrologic unit code.

- Target sediment loads (lbs/acre/year) are based on the average annual sediment load from biologically healthy watersheds (Level IV Ecoregion reference sites).

- TMDLs, WLAs, and LAs are expressed as the percent reduction in average annual sediment load required for a subwatershed containing impaired waterbodies relative to the appropriate target load.

Critical Conditions: Methodology takes into account all flow conditions.

Seasonal Variation: Methodology addresses all seasons.

Margin of Safety (MOS): Implicit (conservative modeling assumptions).

TMDL/Allocations

Storm Water Related Discharges:

Subwatershed	Level IV Ecoregion	Target Sediment Load	% Reduction - Avg. Annual Sediment Load		
			TMDL	WLAs (Construction SW & MS4s)	LAs (Nonpoint Sources)
		[lbs/acre/yr]	[%]	[%]	[%]
0103	68a	128.7	61.9	61.9	61.9
0201	71g	356.9	25.8	25.8	25.8
0202	68a	128.7	76.9	76.9	76.9
0205	71g	356.9	35.9	35.9	35.9
0303	71g	356.9	52.7	52.7	52.7
0305	71g	356.9	50.2	50.2	50.2
0401	71g	356.9	36.5	36.5	36.5
0403	71g	356.9	31.8	31.8	31.8
0601	71g	356.9	59.5	59.5	59.5
0701	71h	597.6	70.6	70.6	70.6
0903	71h	597.6	50.5	50.5	50.5
0905	71h	597.6	33.2	33.2	33.2

Non-storm Water Related Discharges:

WLAs for NPDES regulated wastewater treatment plants are equal to existing permit limits for total suspended solids (TSS).

TOTAL MAXIMUM DAILY LOAD (TMDL) FOR SILTATION/HABITAT ALTERATION UPPER ELK RIVER WATERSHED (HUC 06030003)

1.0 INTRODUCTION

Section 303(d) of the Clean Water Act requires each state to list those waters within its boundaries for which technology based effluent limitations are not stringent enough to protect any water quality standard applicable to such waters. Listed waters are prioritized with respect to designated use classifications and the severity of pollution. In accordance with this prioritization, states are required to develop Total Maximum Daily Loads (TMDLs) for those water bodies that are not attaining water quality standards. State water quality standards consist of designated use(s) for individual waterbodies, appropriate numeric and narrative water quality criteria protective of the designated uses, and an antidegradation statement. The TMDL process establishes the maximum allowable loadings of pollutants for a waterbody that will allow the waterbody to maintain water quality standards. The TMDL may then be used to develop controls for reducing pollution from both point and nonpoint sources in order to restore and maintain the quality of water resources (USEPA, 1991).

2.0 WATERSHED DESCRIPTION

The Upper Elk River Watershed (HUC 06030003) is located in Middle Tennessee (Figure 1), primarily in Coffee, Franklin, Giles, Grundy, Lincoln, Marshall and Moore Counties (a small portion of the watershed is in Bedford County). The Upper Elk River Watershed lies within 2 level III Ecoregions (Southwestern Appalachians, Interior Plateau) and contains 4 level IV Ecoregions as shown in Figure 4 (USEPA, 1997):

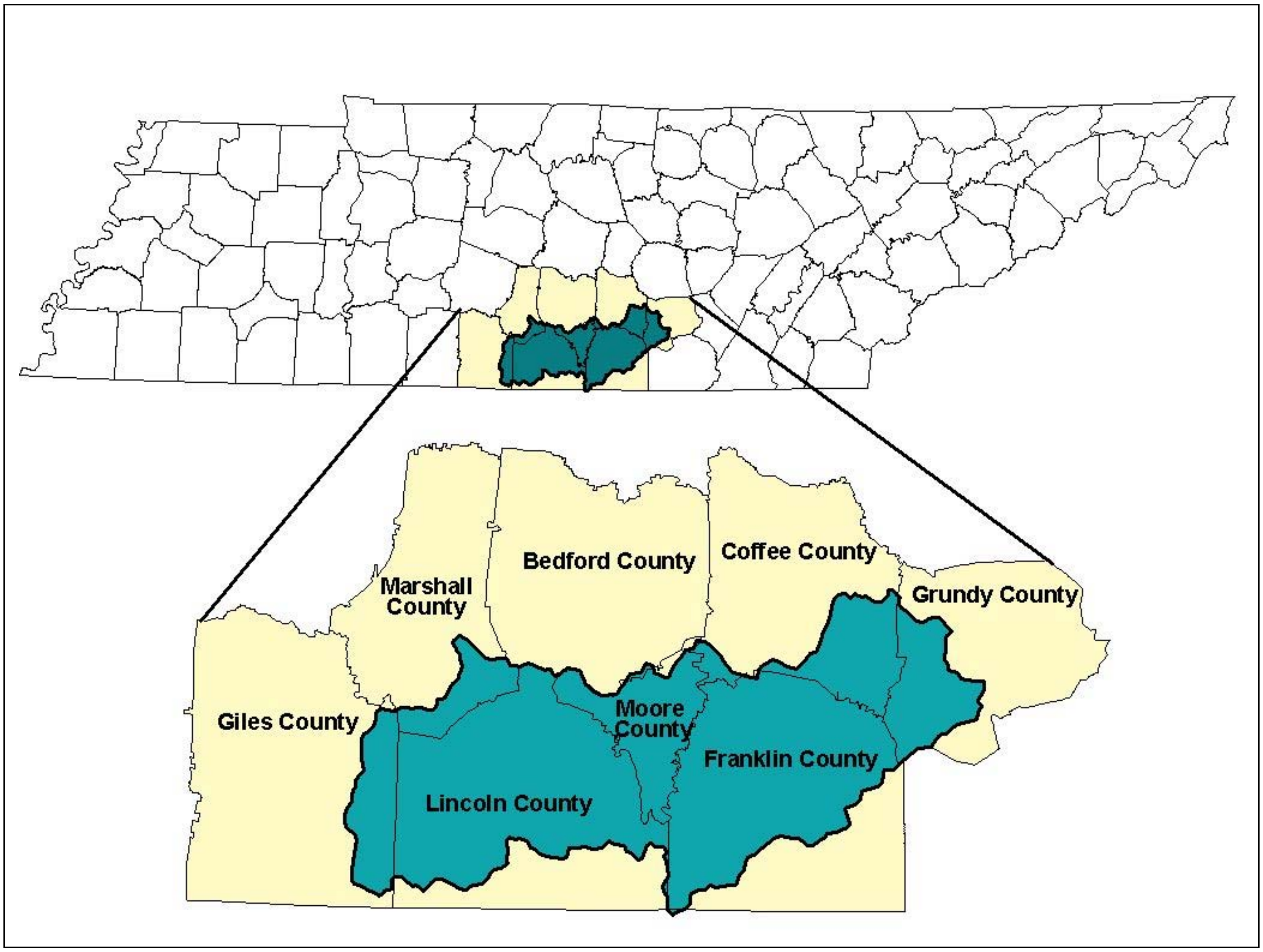
- The Cumberland Plateau's (68a) tablelands and open low mountains are about 1000 feet higher than the ecoregion to the west, and receive slightly more precipitation with cooler annual temperatures than the surrounding lower-elevation ecoregions. The plateau surface is less dissected with lower relief than other ecoregions. Elevations are usually 1200-2000 feet, with the Crab Orchard Mountains reaching over 3000 feet. Pennsylvanian-age conglomerate, sandstone, siltstone, and shale is covered by mostly well-drained, acid soils of low fertility. The region is forested, with some agriculture and coal mining activities.

- The Plateau Escarpment (68c) is characterized by steep, forested slopes and high velocity, high gradient streams. Local relief is often 1000 feet or more. The geologic strata include Mississippian-age limestone, sandstone, shale, and and siltstone, and Pennsylvanian-age shale, siltstone, sandstone, and conglomerate. Streams have cut down into the limestone, but the gorge talus slopes are composed of colluvium with huge angular, slabby blocks of sandstone. Vegetation community types in the ravines and gorges include mixed oak and chestnut oak on the upper slopes, more mesic forests on the middle and lower slopes (beech-tulip poplar, sugar maple-baswood-ash-buckeye), with hemlock along rocky streamsides and river birch along floodplain terraces.

- The Eastern Highland Rim (71g) has level terrain, with landforms characterized as tablelands of moderate relief and irregular plains. Mississippian-age limestone, chert, shale, and dolomite predominate, and karst terrain sinkholes and depressions are especially noticeable between Sparta and McMinnville. Numerous springs and spring-associated fish fauna also typify the region. Natural vegetation for the region is transitional between the oak-hickory type to the west and the mixed mesophytic forests of the Appalachian ecoregions to the east. Bottomland hardwoods forests were once abundant in some areas, although much of the original bottomland forest has been inundated by several large impoundments. Barrens and former prairie areas are now mostly oak thickets or pasture and cropland.

- The Outer Nashville Basin (71h) is a heterogeneous region, with rolling and hilly topography and slightly higher elevations. The region encompasses most all of the outer areas of the generally no-cherty Mississippian-age formations, and some Devonian-age Chattanooga shale, remnants of the Highland Rim. The region's limestone rocks and soils are high in phosphorus, and commercial phosphate is mined. Deciduous forest with pasture and cropland are the dominant land covers. Streams are low to moderate gradient, with productive, nutrient-rich waters, resulting in algae, rooted vegetation, and occasionally high densities of fish. The Nashville Basin as a whole has a distinctive fish fauna, notable for fish that avoid the region, as well as those that are present.

Figure 1 Location of the Upper Elk River Watershed



The Upper Elk River Watershed has approximately 1,813 miles of streams (Rf3), 14,504 lake acres, and 1,837 acres of freshwater wetlands. The watershed drains a total area of 1396 square miles. Watershed land use distribution is based on Multi-Resolution Land Characteristic (MRLC) databases derived from Landsat Thematic Mapper digital images from the period 1990-1993. Land use for the Upper Elk River Watershed is summarized in Table 1 and shown in Figure 3.

Figure 2 Level IV Ecoregions in the Upper Elk River Watershed

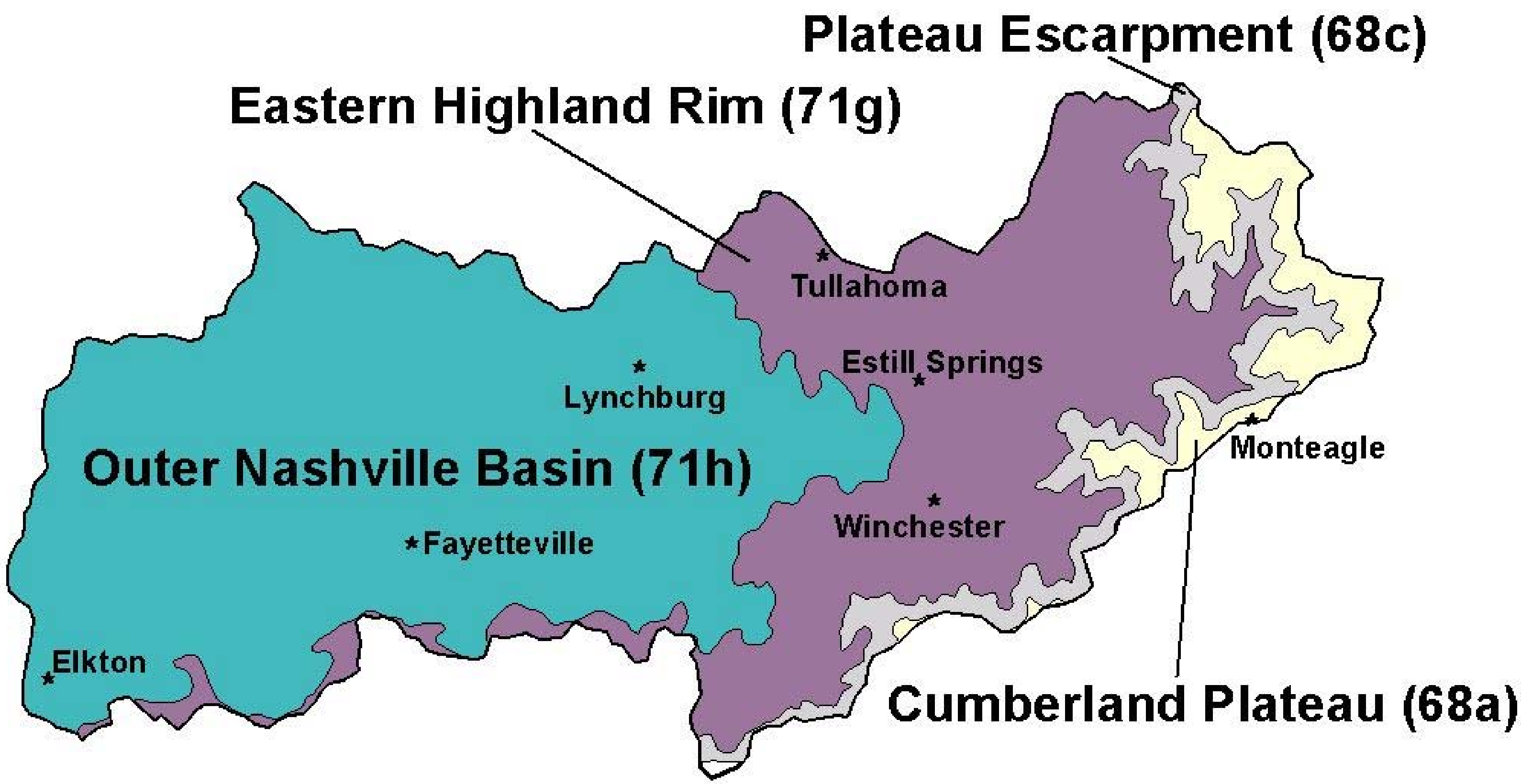


Figure 3 MRLC Land Use in the Upper Elk River Watershed

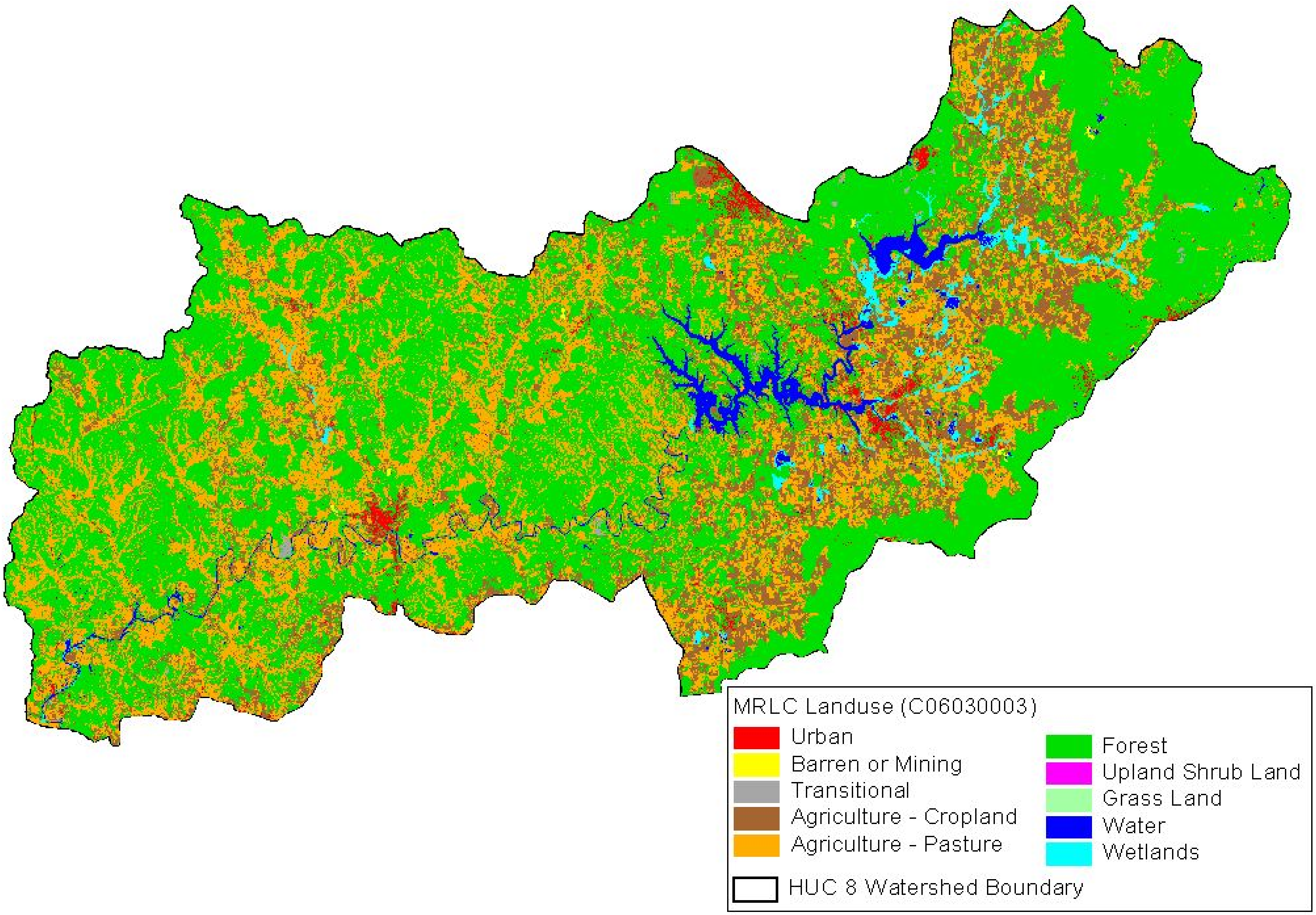


Table 1 Land Use Distribution - Upper Elk River Watershed

Landuse	Area		
	[acres]	[mi^2]	[%]
Open Water	17342.64	27.10	1.94
Low Intensity Residential	5800.82	9.06	0.65
High Intensity Residential	889.12	1.39	0.10
High Intensity Commercial / Industrial / Transportation	4652.62	7.27	0.52
Quarries / Strip Mines / Gravel Pits	494.60	0.77	0.06
Transitional	1582.97	2.47	0.18
Deciduous Forest	303042.40	473.51	33.91
Evergreen Forest	39419.52	61.59	4.41
Mixed Forest	105008.33	164.08	11.75
Pasture / Hay	221375.90	345.91	24.77
Row Crops	176353.05	275.56	19.73
Other Grasses (Urban / Recreational)	4057.51	6.34	0.45
Bare Rock/Sand	0.00	0.00	0.00
Woody Wetlands	12818.11	20.03	1.43
Emergent Herbaceous Wetlands	851.53	1.33	0.10
Total	**893689.12**	**1396.41**	**100.00**

3.0 PROBLEM DEFINITION

Siltation effects impact over 4,000 miles of streams in Tennessee and is by far the most frequently cited pollutant for surface waters. Pollution due to siltation has a significant economic impact due to increased water treatment costs, loss of storage capacity in reservoirs, direct impacts to navigation, and the increased possibility of flooding (TDEC 2000).

Silt alters the physical properties of waters by:

- Restricting or preventing light penetration
- Altering temperature patterns
- Decreasing the depth of pools or lakes
- Changing flow patterns

Silt alters the chemical properties of waters by:

- Interfering with photosynthesis
- Causing an increase in sediment oxygen demand due to decomposition of organic material
- Increasing nutrient levels which can accelerate eutrophication
- Transporting organic chemicals and metals into the water column (especially if the original disturbed site was contaminated)

Silt alters the biological properties of waters by:

- Smothering eggs and nests of fish
- Piggybacking other pollutants in possibly toxic amounts or providing a reservoir of substances that may bioconcentrate in the food chain
- Clogging the gills of fish and other forms of aquatic life
- Interfering with the feeding of fish species that find food by sight
- Covering substrate that provides habitat for benthic organisms that provide food for fish
- Reducing biological integrity by altering habitats to favor burrowing species
- Accelerating the growth of submerged aquatic plants

The State of Tennessee's final 1998 303(d) list (TDEC, 1998) was approved by the U.S. Environmental Protection Agency (EPA), Region IV on September 17, 1998. The list identified a number of waterbodies in the Upper Elk River watershed as not fully supporting designated use classifications due, in part, to siltation associated with crop production and resource extraction (see Table 2). The designated use classifications for the Upper Elk River and its tributaries include fish and aquatic life, irrigation, livestock watering & wildlife, and recreation. Some waterbodies in the watershed are also classified for industrial water supply and/or domestic water supply. These TMDLs are established to attain full support of the designated use of fish and aquatic life. This approach will also protect all other designated uses.

Waterbodies in the Upper Elk River watershed were reassessed by the State in 2000 and in 2002 using more recent data and a revised waterbody identification system. In September 2002, the State of Tennessee submitted to the USEPA, the Proposed Final 2002 303(d) List. This list identified a number of waterbodies in the Upper Elk River watershed as not supporting designated use classifications due, in part, to siltation and/or habitat alteration (see Table 3). These TMDLs address all subwatersheds in the Upper Elk River watershed. All waterbodies listed on both the 1998 303(d) list and the Proposed Final 2002 303(d) List are provided a TMDL for sediment loading. These waterbodies are shown in Figure 4.

Table 2 1998 303(d) List for Siltation/Habitat Alteration - Upper Elk River Watershed

Waterbody ID	Waterbody	RM Partially Supporting	RM Not Supporting	Cause (Pollutant)	Source (Pollutant)
6030003006	Coldwater Creek	48.5		Siltation	Agriculture
6030003027	Dry Creek	24.8		Siltation	Agriculture
6030003053	Rock Creek	10.8		Siltation	Municipal Point Source Land Development
6030003065	Indian Creek	45.3		Siltation	Agriculture
060300030850.7	Childer Creek	8.9		Siltation	Agriculture

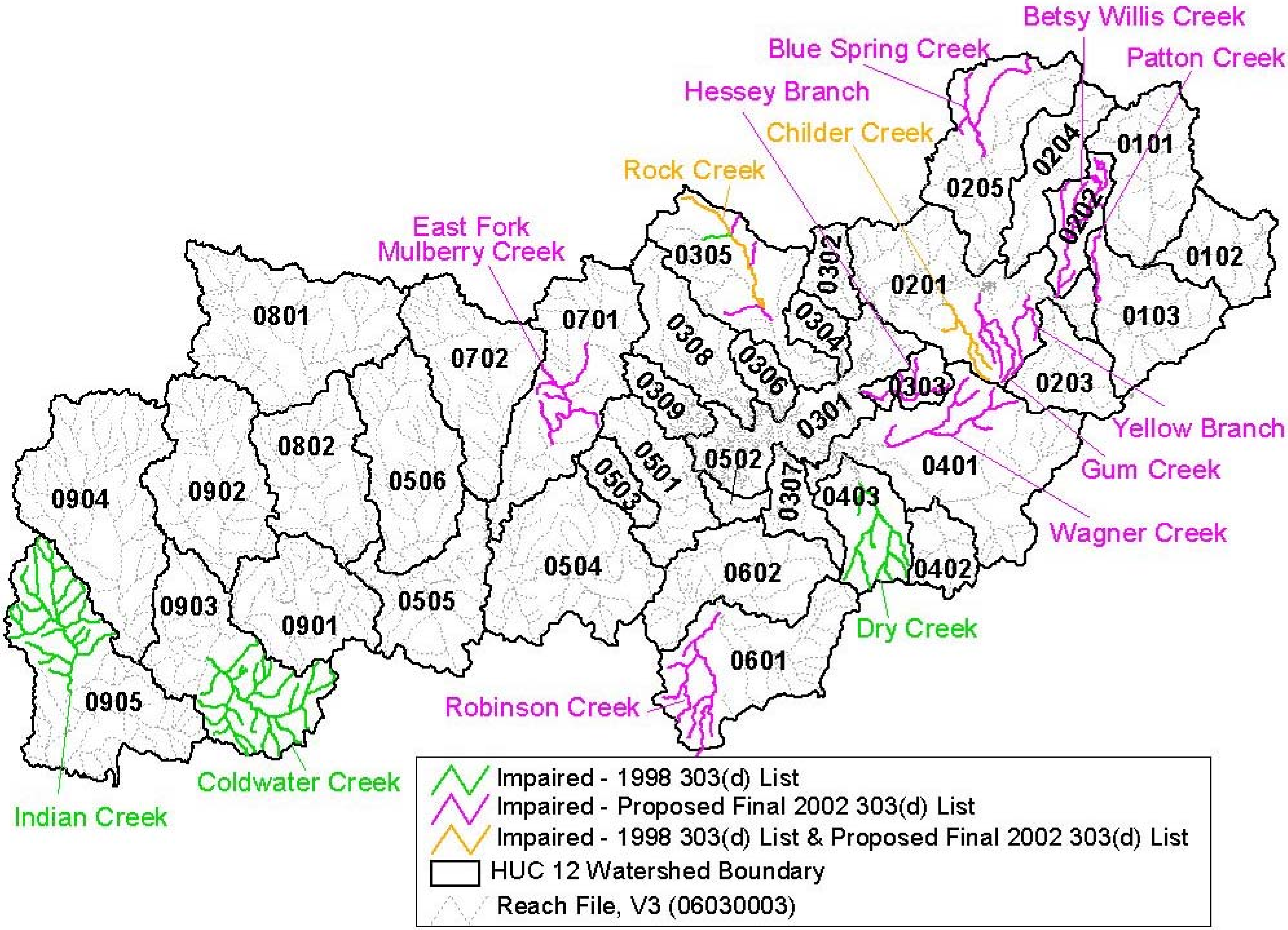
Table 3 Proposed Final 2002 303(d) List - Stream Impairment Due to Siltation/Habitat Alteration in the Upper Elk River Watershed

Waterbody ID	Waterbody	RM Partially Supporting	RM Not Supporting	Cause (Pollutant)	Reference to 1998 303(d) List
06030003012_0400	Robinson Creek	23.0		Siltation	NA
06030003032_1000	Wagner Creek	18.8		Other Habitat Alterations	NA
06030003041_0100	Yellow Branch		7.1	Siltation Other Habitat Alterations	NA
06030003044_0100	Betsy Willis Creek		22.5	Siltation Other Habitat Alterations	NA
06030003044_0200	Patton Creek		4.2	Siltation Other Habitat Alterations	NA
06030003051_0200	Blue Spring Creek	13.0		Other Habitat Alterations	NA

Table 3 (cont.) Proposed Final 2002 303(d) List - Stream Impairment Due to Siltation/Habitat Alteration in the Upper Elk River Watershed

Waterbody ID	Waterbody	RM Partially Supporting	RM Not Supporting	Cause (Pollutant)	Reference to 1998 303(d) List
06030003053_2000	Rock Creek		16.1	Siltation	6030003053
06030003056_0300	East Fork Mulberry Creek	16.8		Siltation	NA
06030003085_1000	Childer Creek	8.9		Siltation	060300030850.7
06030003552_1000	Gum Creek		12.9	Siltation Other Habitat Alterations	NA
06030003567_1000	Hessey Branch		9.6	Siltation	NA

Figure 4 Waterbodies Impaired Due to Siltation/Habitat Alteration - 1998 303(d) List & Proposed Final 2002 303(d) List



4.0 TARGET IDENTIFICATION

Several narrative criteria, applicable to siltation/habitat alteration, are established in *State of Tennessee Water Quality Standards, Chapter 1200-4-3 General Water Quality Criteria, October, 1999* (TDEC, 1999):

Applicable to all use classifications (Fish & Aquatic Life shown):

> Solids, Floating Materials, and Deposits – There shall be no distinctly visible solids, scum, foam, oily slick, or the formation of slimes, bottom deposits or sludge banks of such size and character that may be detrimental to fish and aquatic life.
>
> Other Pollutants – The waters shall not contain other pollutants that will be detrimental to fish or aquatic life.

Applicable to the Domestic Water Supply, Industrial Water Supply, Fish & Aquatic Life, and Recreation use classifications (Fish & Aquatic Life shown):

> Turbidity or Color – There shall be no turbidity or color in such amounts or of such character that will materially affect fish and aquatic life.

Applicable to the Fish & Aquatic Life use classification:

> Biological Integrity - The waters shall not be modified through the addition of pollutants or through physical alteration to the extent that the diversity and/or productivity of aquatic biota within the receiving waters are substantially decreased or adversely affected, except as allowed under 1200-4-3-.06. The condition of biological communities will be measured by use of metrices suggested in guidance such as Rapid Bioassessment Protocols for Use in Streams and Rivers (EPA/444/4-89-001) or other scientifically defensible methods. Effects to biological populations will be measured by comparisons to upstream conditions or to appropriately selected reference sites in the same ecoregion (See definition).

These TMDLs are being established to attain full support of the fish and aquatic life designated use classification. TMDLs established to protect fish and aquatic life will protect all other use classifications for the identified waterbodies from adverse alteration due to sediment loading.

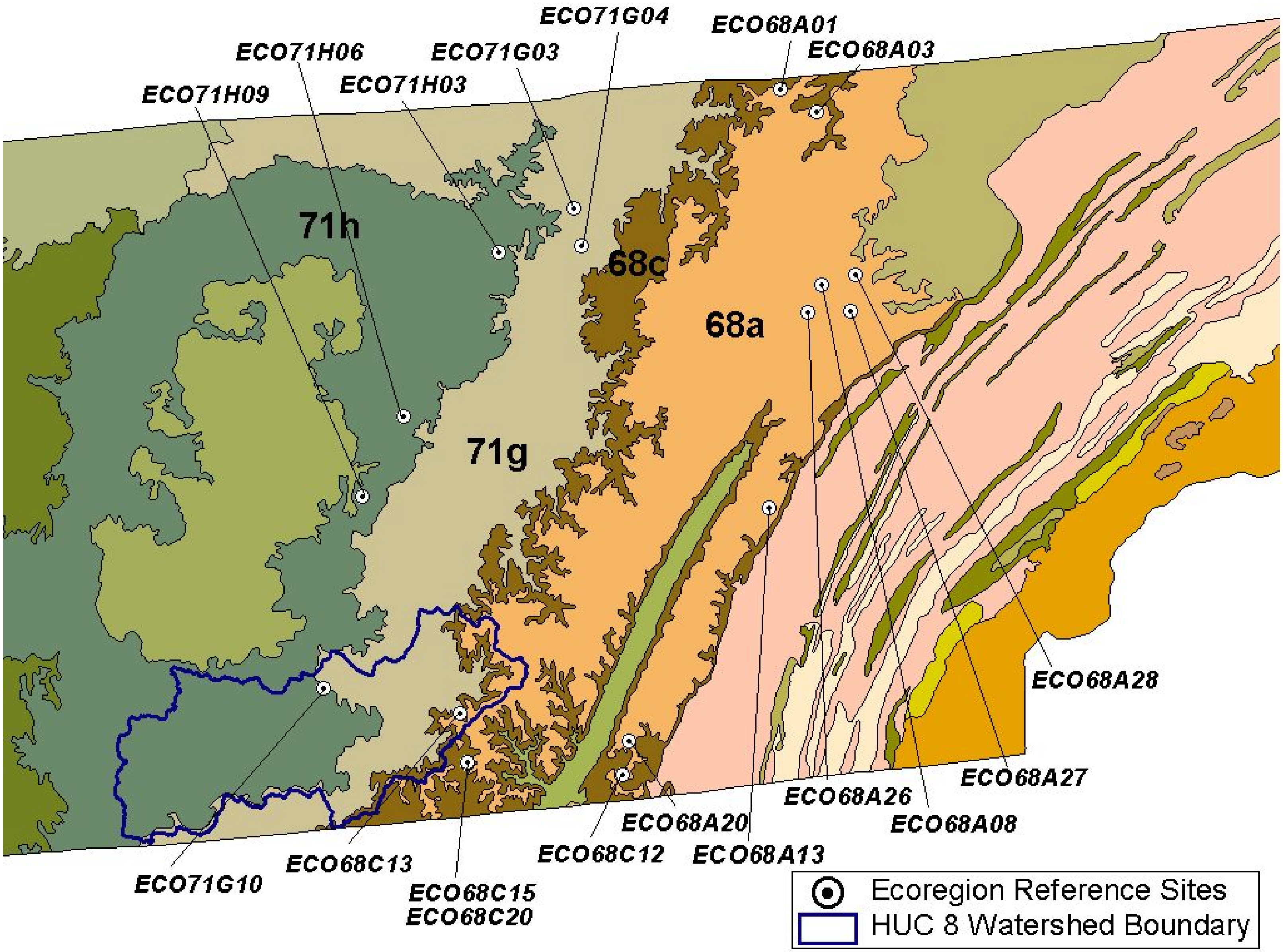
In order for a TMDL to be established, a numeric “target” protective of the uses of the water must be identified to serve as the basis for the TMDL. Where State regulation provides a numeric water quality criteria for the pollutant, the criteria is the basis for the TMDL. Where State regulation does not provide a numeric water quality criteria, as in the case of siltation/habitat alteration, a numeric interpretation of the narrative water quality standard must be determined. For the purpose of these TMDLs, the average annual sediment loading in lbs/acre/yr, from a biologically healthy watershed, located within the same Level IV ecoregion as the impaired watershed, is determined to be the appropriate numeric interpretation of the narrative water quality standard for protection of fish and aquatic life. Biologically healthy watersheds were identified from the State’s ecoregion reference sites. These ecoregion reference sites have similar characteristics and conditions as the majority of streams within that ecoregion. Detailed information regarding Tennessee ecoregion reference sites can be found in *Tennessee Ecoregion Project, 1994-1999* (TDEC 2000a). In general, land use in ecoregion reference watersheds contain less pasture, cropland, and urban areas, and more forested areas compared to the impaired watersheds. The biologically healthy (reference) watersheds are considered the "least impacted" in an ecoregion and, as such, sediment loading from these watersheds may serve as an appropriate target for the TMDL.

Using the methodology described in Appendix A, the Watershed Characterization System (WCS) Sediment Tool was used to calculate the average annual sediment load for each of the biologically healthy (reference) watersheds in Level IV ecoregions 68a, 68c, 71g, and 71h. The geometric mean of the average annual sediment loads of the reference watersheds in each Level IV ecoregion was selected as the most appropriate target for that ecoregion. Since the impairment of biological integrity due to sediment build-up is generally a long-term process, using an average annual load is considered appropriate. The average annual sediment loads for reference sites and corresponding TMDL target values for Level IV ecoregions 68a, 68c, 71g, and 71h are summarized in Table 4. Reference site locations are shown in Figure 5.

Table 4 Average Annual Sediment Loads of Level IV Ecoregion Reference Sites

Level 4 Ecoregion	Reference Site	Stream	Drainage Area	Average Annual Sediment Load
			(acres)	[lbs/acre/year]
68a	ECO68A01	Rock Creek	3721	41.8
	ECO68A03	Laurel Fork	10831	86.3
	ECO68A08	Clear Creek	98945	159.1
	ECO68A13	Piney Creek	8948	156.1
	ECO68A20	Mullens Creek	7389	122.1
	ECO68A26	Daddy's Creek	39938	367.1
	ECO68A27	Island Creek	11848	179.3
	ECO68A28	Rock Creek	16043	104.4
	Geometric Mean (Target Load)			**128.7**
68c	ECO68C12	Ellis Gap Branch	811	91.6
	ECO68C13	Mud Creek	2630	233.3
	ECO68C15	Crow Creek	14120	223.8
	ECO68C20	Crow Creek	12626	183.8
	Geometric Mean (Target Load)			**172.2**
71g	ECO71G03	Flat Creek	14151	340
	ECO71G04	Spring Creek	17100	496.3
	ECO71G10	Hurricane Creek	3563	269.3
	Geometric Mean (Target Load)			**356.9**
71h	ECO71H03	Flynn Creek	8316	735.7
	ECO71H06	Clear Fk. Creek	8782	559.3
	ECO71H09	Carson Fork	7937	518.6
	Geometric Mean (Target Load)			**597.6**

Figure 5 Reference Sites in Level IV Ecoregions 68a, 68c, 71g, & 71h



5.0 WATER QUALITY ASSESSMENT AND DEVIATION FROM TARGET

Using the methodology described in Appendix A, the WCS Sediment Tool was used to determine the average annual sediment load for all subwatersheds (corresponding to 12-digit HUCs) in the Upper Elk River watershed (Figure 6). The estimated existing average annual loads for subwatersheds with waterbodies listed on the 1998 303(d) list or in the Proposed Final 2002 303(d) List as impaired for siltation/habitat alteration are summarized in Table 5.

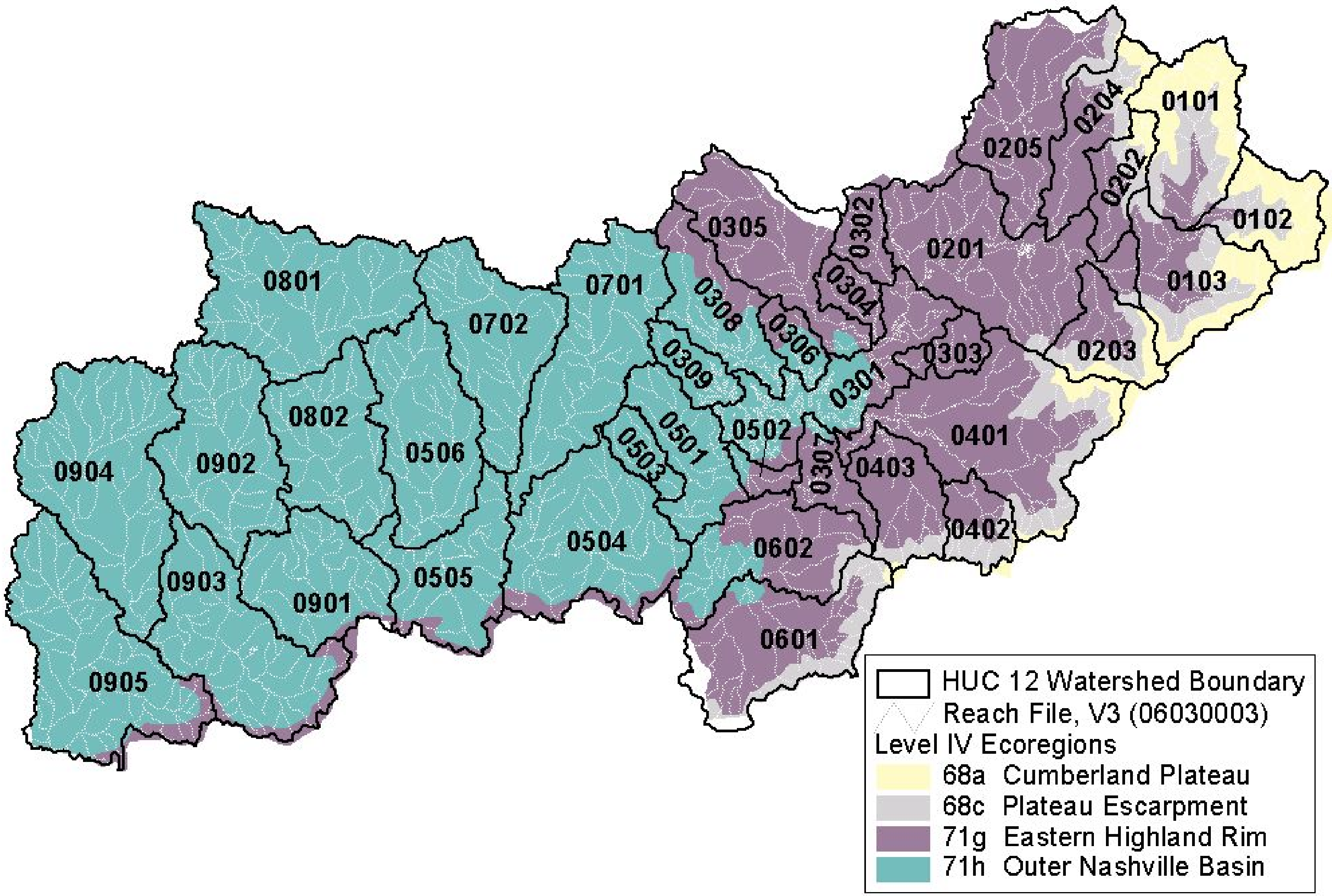
Table 5 Existing Sediment Loads in Subwatersheds With Impaired Waterbodies

Subwatershed	Level IV Ecoregion	Existing Sediment Load [lbs/acre/year]
60300030103	68a	337
60300030201	71g	481
60300030202	68a	556
60300030205	71g	557
60300030303	71g	754
60300030305	71g	717
60300030401	71g	562
60300030403	71g	523
60300030601	71g	882
60300030701	71h	2034
60300030903	71h	1208
60300030905	71h	895

6.0 SOURCE ASSESSMENT

An important part of the TMDL analysis is the identification of individual sources, source categories, or source subcategories of siltation in the watershed and the amount of pollutant loading contributed by each of these sources. Under the Clean Water Act, sources are broadly classified as either point or nonpoint sources. Under 40 CFR 122.2, a point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. The National Pollutant Discharge Elimination System (NPDES) program regulates point source discharges. Regulated point sources include: 1) municipal and industrial wastewater treatment facilities (WWTFs); 2) storm water discharges associated with industrial activity (which includes construction activities); and 3) certain discharges from Municipal Separate Storm Sewer Systems (MS4s). A TMDL must provide Waste Load Allocations (WLAs) for all NPDES-regulated point sources. For the purposes of these TMDLs, all sources of sediment loading not regulated by NPDES are considered nonpoint sources. The TMDL must provide a Load Allocation (LA) for these sources.

Figure 6 Upper Elk River Watershed – Subwatershed Delineation



6.1 Point Sources

6.1.1 NPDES-Regulated Municipal and Industrial Wastewater Treatment Facilities

Discharges from WWTFs may contribute sediment to receiving waters as Total Suspended Solids (TSS) and/or turbidity. There are 25 facilities with NPDES permits that require monitoring of TSS or turbidity in the Upper Elk River watershed (see Figure 7). These discharges are summarized in Table 6. Sediment loads to the receiving streams from WWTFs are negligible in relation to sediment discharges caused by storm water runoff. The annual total of WWTF discharges in each subwatershed impaired for sediment in the Upper Elk River watershed is calculated to be less than 3% of the total sediment loading in those subwatersheds. The TSS component of WWTF discharges is generally composed more of organic material and, therefore, provides less direct impact to the biological integrity of the stream (through settling and accumulation) than would stream sedimentation due to soil erosion.

6.1.2 NPDES Regulated Mining Sites

Discharges from regulated mining activities may also contribute sediment to surface waters as TSS. Discharges from active mines may result from dewatering operations and/or in response to storm events. Discharges from permitted inactive mines are only in response to storm events. Inactive sites with successful surface reclamation contribute relatively little solids loading. Permitted mining sites in the Upper Elk River Watershed are shown in Figure 7 and summarized in Table 7. Sediment loads (as TSS) to waterbodies from mining site discharges are negligible in relation to total sediment loading. The estimated sediment load from active or reclaimed mining site discharges in subwatersheds impaired for siltation/habitat alteration in the Upper Elk River watershed is calculated to be less than 2% of the total sediment loading in those subwatersheds.

6.1.3 NPDES-Regulated Construction Activities

Sediment loadings from NPDES-regulated construction activities are considered point sources of sediment to surface waters. These discharges occur in response to storm events. Currently, discharges of storm water from construction activities disturbing an area of five acres or more must be authorized by an NPDES permit. Most of these construction sites obtain coverage under NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity*. In some cases, for discharges into 303(d) listed waters, sites may be required to obtain coverage under an individual NPDES permit. Beginning March 10, 2003, discharge of storm water from construction activities disturbing between one and five acres must also be authorized by an NPDES permit. The purpose of these NPDES permits is to eliminate or minimize the discharge of pollutants from construction activities. Since construction activities at a site are of a temporary, relatively short term nature, the number of construction sites covered by the general permit at any instant of time varies. In the Upper Elk River watershed, there were 6 permitted active construction sites on February 12, 2003 (See Figure 8).

Figure 7 NPDES Facilities Permitted to Discharge TSS in the Upper Elk River Watershed

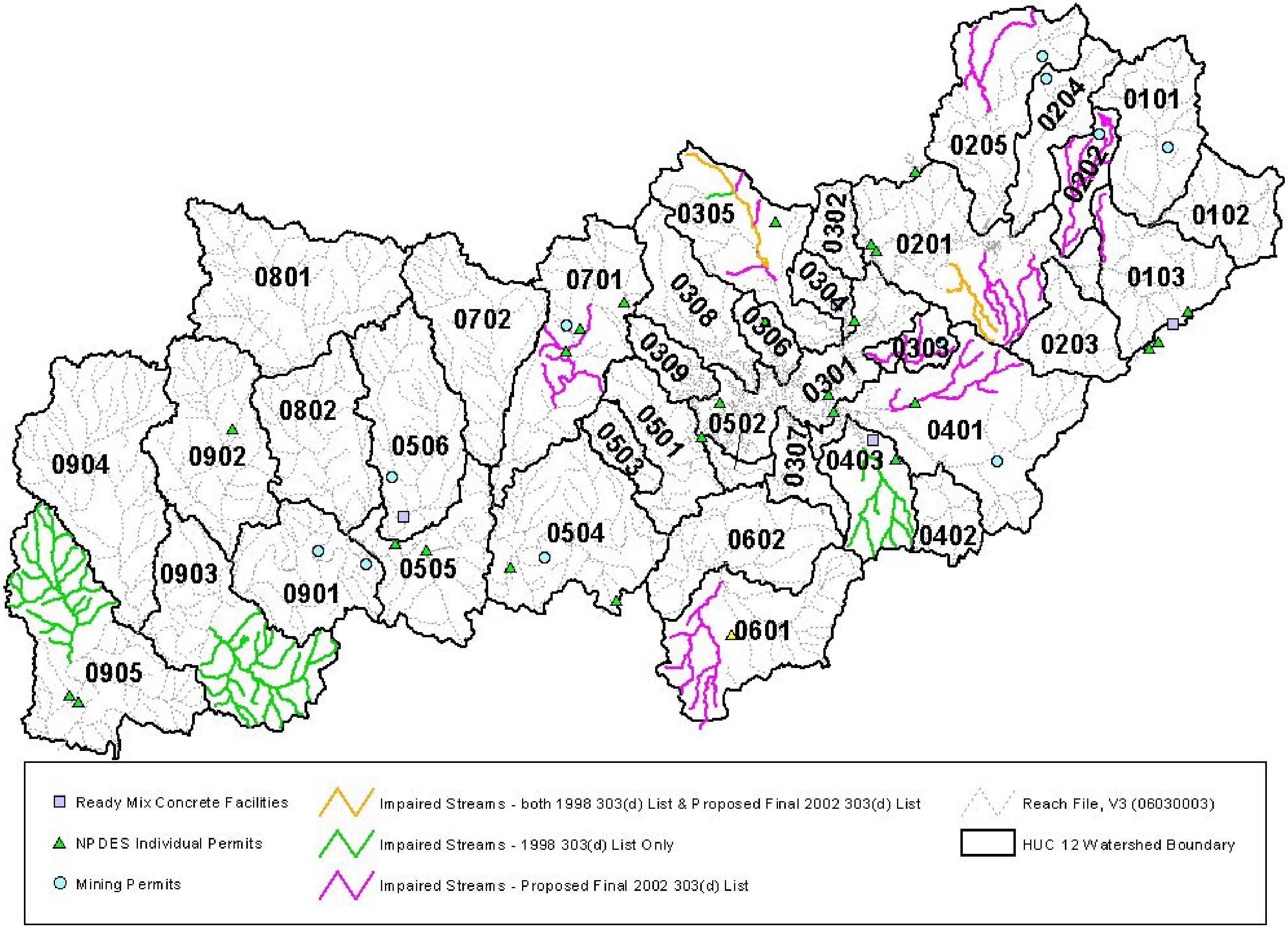


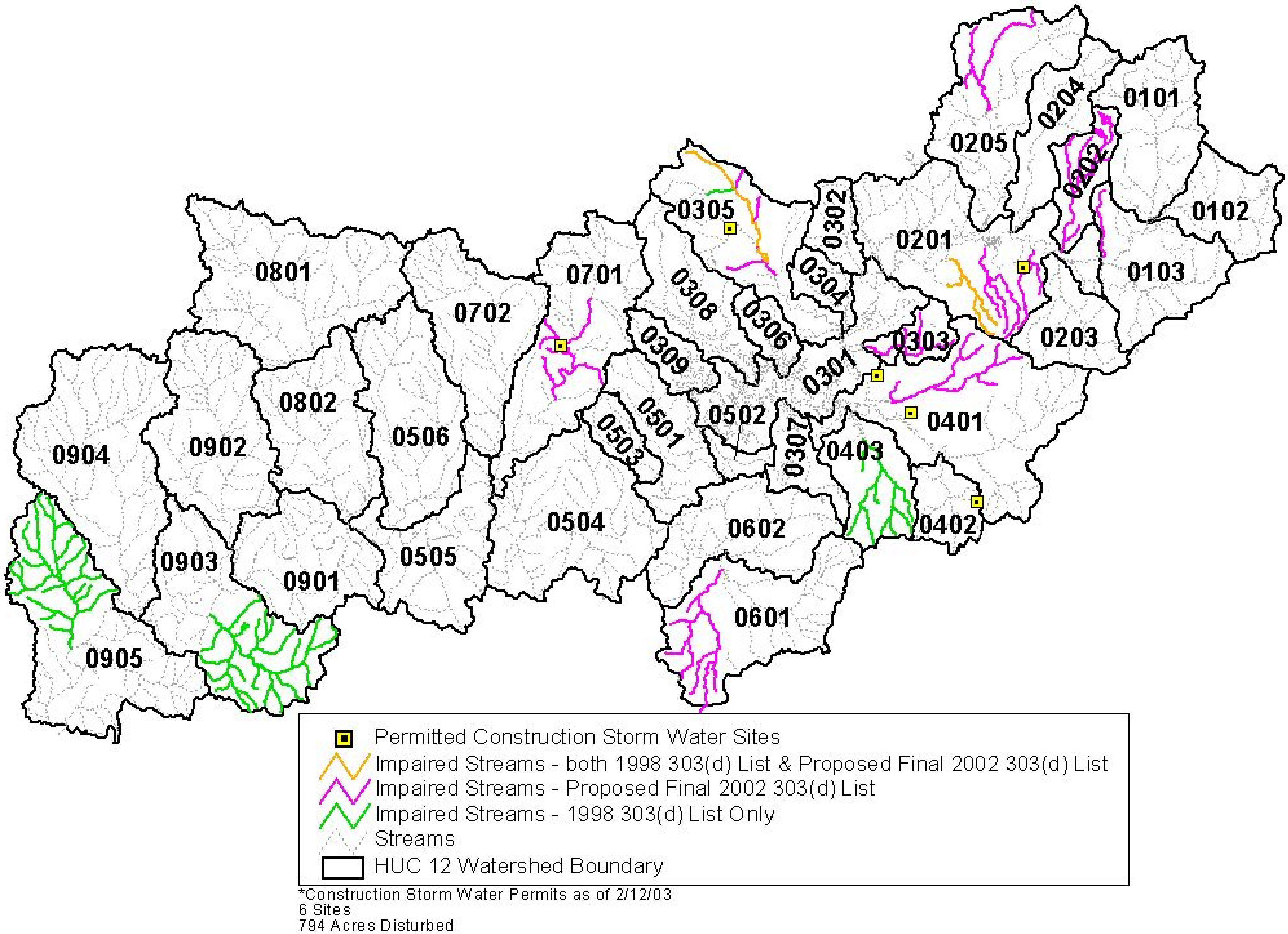
Table 6 NPDES Facilities Permitted to Discharge TSS in the Upper Elk River Watershed

Sub-watershed	Sub-watershed Area	NPDES Permit No.	Facility	Design Flow	NPDES Permit Limit - TSS				
					Monthly Average		Weekly Average		Daily Maximum
	[acres]			[MGD]	[mg/l]	[lbs/day]	[mg/l]	[lbs/day]	[mg/l]
0701	35296	TN0001953	Jack Daniel Distillery, Lem Motlow Prop., Inc.	3.083	---	---	---	---	40
0201	40145	TN0003751	Arnold Engineering Development Center	0.021	30	---	---	---	45
0505	23144	TN0004979	Fayetteville WTP	0.146	---	---	---	---	40
0504	35899	TN0005037	TN Game & Fish Flintville	2.133	---	---	---	---	40
0301	25269	TN0005665	Winchester Water System WTP	0.09	---	---	---	---	40
0401	44456	TN0020508	Decherd City STP	0.5	30	125	40	167	45
0403	14653	TN0021644	Cowan STP	0.4	30	100	40	133	45
0103	21436	TN0021806	Monteagle STP, Plant #1	0.25	30	63	40	83	45
0505	23144	TN0021814	Fayetteville STP	3.35	30	838	40	1118	45
0301	25269	TN0021857	Winchester STP	3.2	30	801	40	1068	45
0305	26941	TN0023469	Tullahoma STP	5	30	1251	40	1668	45
0701	35296	TN0025101	Lynchburg STP	0.3	30	75	40	100	45
0502	3130	TN0027766	TDEC-Tims Ford State Park	0.04	30	---	---	---	45
0201	40145	TN0056430	The University of Tennessee Space Institute	0.0063	---	---	---	---	40
0103	21436	TN0060372	Monteagle WTP	0.031	---	---	---	---	40
0701	35296	TN0061191	Lynchburg Water Dept.	0.024	---	---	---	---	40
0103	21436	TN0064815	Monteagle STP, Plant #2	0.25	30	63	40	83	45
0902	32138	TN0065498	Unity Junior High School	0.0072	30	---	---	---	45
0201	40145	TN0067202	University of Tennessee Space Institute	0.02	30	---	---	---	45
0504	35899	TN0068462	Teal Hollow Springs WTP	0.189	---	---	---	---	40
0306	5550	TN0073687	Center Grove Winchester Springs Utility District	0.125	---	---	---	---	40
0905	42446	TN0074331	TDOT I-65 Welcome Center - Giles County	0.018	30	---	---	---	45
0304	5292	TN0074837	Estill Springs Water Treatment Plant	0.51	---	---	---	---	40
0601	30903	TN0074853	Huntland WTP	0.166	---	---	---	---	40
0905	42446	TN0076007	Elkton STP	0.008	10	---	---	---	20

Table 7 NPDES Regulated Mining Sites in the Upper Elk River Watershed

Subwatershed	NPDES Permit No.	Name	Area	TSS Daily Maximum Limit	Status
			[acres]	[mg/l]	
0204	TN0065986	ROGERS GROUP, INC. HILLSBORO QUARRY	118.5	40	Active
0205	TN0066028	COFFEE COUNTY HIGHWAY DEPARTMENT HIGHWAY DEPARTMENT ROCK QUARRY	40	40	Active
0901	TN0066176	LINCOLN COUNTY HIGHWAY DEPT. ROCK QUARRY	160.35	40	Active
0701	TN0066273	ROGERS GROUP, INC. LYNCHBURG QUARRY	98.37	40	Active
0401	TN0066311	ROGERS GROUP, INC. COWAN QUARRY	177.9	40	Active
0101	TN0066541	ROGERS GROUP, INC. GRUNDY COUNTY QUARRY	14.1	40	Active
0303	TN0068951	FRANKLIN COUNTY HIGHWAY DEPARTMENT HIGHWAY DEPARTMENT ROCK QUARRY	25	40	Active
0901	TN0070815	BURGREEN CONTRACTING CO., INC. PITTS BEND MINE	80	40	Active
0506	TN0070874	ROGERS GROUP, INC. FAYETTEVILLE QUARRY	126.3	40	Active
0202	TN0071781	CUMBERLAND MOUNTAIN SAND SOUTH PIT	141.4	40	Active
0504	TN0076171	HMA CONTRACTORS, LLC HMA KELSO QUARRY	78.3	40	Active

Figure 8 Location of NPDES Permitted Construction Sites in the Upper Elk River Watershed



6.1.4 NPDES-Regulated Municipal Separate Storm Sewer Systems

MS4s also discharge sediment to waterbodies in response to storm events through road drainage systems, curb and gutter systems, ditches, and storm drains. These systems convey urban runoff from surfaces such as bare soil and wash-off of accumulated street dust and litter from impervious surfaces during rain events. Large and medium MS4s serving populations greater than 100,000 people are required to obtain a NPDES storm water permit. At present, there are no MS4s of this size in the Upper Elk River Watershed. On November 25, 2002 the MS4 Phase II was put out on public notice. Small MS4s serving urbanized areas will be required to obtain a permit under the Phase II storm water regulations. An urbanized area is defined as an entity with a residential population of at least 50,000 people and an overall population density of 1,000 people per square mile. Tullahoma will be covered under Phase II of the NPDES Storm Water Program. This city is required to submit permit applications by March 10, 2003. The Tennessee Department of Transportation (TDOT) is also being issued MS4 permits for state roads in urban areas.

6.2 Nonpoint Sources

Nonpoint sources account for the vast majority of sediment loading to surface waters. These sources include:

- Natural erosion occurring from the weathering of soils, rocks, and uncultivated land; geological abrasion; and other natural phenomena.

- Erosion from agricultural activities can be a major source of sedimentation due to the large land area involved and the land-disturbing effects of cultivation. Grazing livestock can leave areas of ground with little vegetative cover. Unconfined animals with direct access to streams can cause streambank damage.

- Urban erosion from bare soil areas under construction and washoff of accumulated street dust and litter from impervious surfaces.

- Erosion from unpaved roadways can be a significant source of sediment to rivers and streams. It occurs when soil particles are loosened and carried away from the roadway, ditch, or road bank by water, wind, or traffic. The actual road construction (including erosive road-fill soil types, shape and size of coarse surface aggregate, poor subsurface and/or surface drainage, poor road bed construction, roadway shape, and inadequate runoff discharge outlets or “turn-outs” from the roadway) may aggravate roadway erosion. In addition, external factors such as roadway shading and light exposure, traffic patterns, and road maintenance may also affect roadway erosion. Exposed soils, high runoff velocities and volumes, and poor road compaction all increase the potential for erosion

- Runoff from abandoned mines may be significant sources of solids loading. Mining activities typically involve removal of vegetation, displacement of soils and other significant land disturbing activities.

- Soil erosion from forested land that occurs during timber harvesting and reforestation activities. Timber harvesting includes the layout of access roads, log decks, and skid trails; the construction and stabilization of these areas; and the cutting of trees. Established forest areas produce very little soil erosion.

For the listed waterbodies within the Upper Elk River Watershed, the primary sources of nonpoint sediment loads come from agriculture, roadways, and urban sources.

7.0 DEVELOPMENT OF TOTAL MAXIMUM DAILY LOAD

The TMDL is the total amount of a pollutant that can be loaded into a waterbody (the loading capacity) and still attain the applicable water quality standard. A TMDL is expressed as Waste Load Allocations (WLAs) for point source discharges from facilities and activities regulated by the NPDES permit program and Load Allocations (LAs) for all nonpoint sources. The TMDL must also provide an appropriate margin of safety (MOS) which takes into account any uncertainty concerning the relationship between effluent limitations and water quality.

Sediment analysis for watersheds can be conducted using methods ranging from simple, gross estimates to complex dynamic loading and receiving water models. The choice of methodology is dependent on a number of factors that include: watershed size, type of impairment, type and quantity of data available, resources available, time, and cost. In consideration of these factors, the following approach was selected as the most appropriate for first phase sediment TMDLs in the Upper Elk River watershed:

- The Watershed Characterization System (WCS) Sediment Tool was used to determine sediment loading to Level IV ecoregion reference site watersheds. These are considered to be biologically healthy watersheds. The average annual sediment loads in lbs/acre/yr of these reference watersheds serve as target values for the Upper Elk River watershed sediment TMDLs.

- The Sediment Tool was also used to determine the existing average annual sediment loads of impaired watersheds located in the same Level IV ecoregion. Impaired watersheds are defined as 12-digit HUCs containing one or more waterbodies identified as impaired due to siltation/habitat alteration on the State's 1998 303(d) list and/or Proposed Final 2002 303(d) List (ref: Figure 4).

- The average annual sediment load of each impaired watershed was compared to the average annual load of the appropriate reference (biologically healthy) watershed and a required percent reduction in loading calculated. Although the Sediment Tool uses the best road, elevation, and land use GIS coverages available, the resulting average annual sediment loads should not be interpreted as an absolute value. The calculated loading reductions, however, are considered to be valid since they are based on the relative comparison of loads calculated using the same methodology.

- TMDLs, WLAs, and LAs are expressed as a percent reduction in average annual sediment loading. It is considered that the reduction of sediment loading as specified by WLAs and LAs in impaired watersheds will result in the attainment of fully supporting status for all designated use classifications, with respect to siltation/habitat alteration. According to 40 CFR §130.2 (i), TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure.

This approach is recognized as an acceptable alternative to a maximum allowable mass load per day in the *Protocol for Developing Sediment TMDLs* (USEPA, 1999). Target loading and sediment TMDLs for subwatersheds containing waterbodies identified as impaired for siltation/habitat alteration are summarized in Table 8.

7.1 Waste Load Allocations

7.1.1 Waste Load Allocations for NPDES-Regulated Municipal and Industrial Wastewater Treatment Facilities

There are a total of 25 facilities in the Upper Elk River Watershed with individual NPDES permits that require monitoring of TSS or turbidity. Fifteen of these facilities are located in subwatersheds with waterbodies identified as impaired due to siltation/habitat alteration on either the 1998 303(d) or Proposed Final 2002 303(d) List. WLAs, at a level equal to their permit limits for TSS, are provided for each of these facilities (see Table 9). It is considered appropriate to provide these facilities their current discharge levels of TSS since the sediment loading from these facilities is negligible compared to other sources. WWTFs contribute 3%, or less, of the total sediment loading to surface waters in impaired subwatersheds. In addition, sediment loads from WWTFs are generally composed more of organic material and, therefore, provide less direct impact to biological integrity (through settling and accumulation) than would direct soil loss to the streams.

7.1.2 Waste Load Allocations for NPDES-Regulated Mining Activities

Of the 11 mines in the Upper Elk River Watershed with NPDES permits,five are located in impaired subwatersheds (ref: Table 8). All of these are limestone quarries. Since sediment loading from mine sites is less than 2% of the total loading for Subwatersheds 060300030202, 060300030205, 060300030303, 060300030401 and 060300030701, WLAs are considered to be equal to the existing permit requirements for these sites.

Table 8 Sediment TMDLs for Subwatersheds with Waterbodies Impaired for Siltation/Habitat Alteration

Subwatershed	Waterbody ID	Waterbody Impaired by Siltation/Habitat Alteration	Listing	Level IV Ecoregion	Existing Sediment Load [lbs/acre/yr]	Target Load [lbs/acre/yr]	TMDL (required load reduction) [%]
0103	06030003044_0200	Patton Creek	2002 Assess.	68a	337	128.7	61.9
0201	06030003041_0100	Yellow Branch	2002 Assess.	71g	481	356.9	25.8
	06030003552_1000	Gum Creek	2002 Assess.				
	06030003085_1000	Childer Creek	1998 303(d) & 2002 Assess.				
0202	06030003044_0100	Betsy Willis Creek	2002 Assess.	68a	556	128.7	76.9
0205	06030003051_0200	Blue Spring Creek	2002 Assess.	71g	557	356.9	35.9
0303	06030003567_1000	Hessey Branch	2002 Assess.	71g	754	356.9	52.7
0305	06030003053_2000	Rock Creek	1998 303(d) & 2002 Assess.	71g	717	356.9	50.2
0401	06030003032_1000	Wagner Creek	2002 Assess.	71g	562	356.9	36.5
0403	6030003027	Dry Creek	1998 303(d)	71g	523	356.9	31.8
0601	06030003012_0400	Robinson Creek	2002 Assess.	71g	882	356.9	59.5
0701	06030003056_0300	East Fork Mulberry Creek	2002 Assess.	71h	2034	597.6	70.6
0903	6030003006	Coldwater Creek	1998 303(d)	71h	1208	597.6	50.5
0905	6030003065	Indian Creek	1998 303(d)	71h	895	597.6	33.2

Table 9 WLAs for NPDES Permitted Municipal and Industrial Wastewater Treatment Facilities

Sub-watershed	NPDES Permit No.	Facility	WLA (as TSS)	
			Flow	Monthly Average Permit Limit
			[MGD]	[mg/L]
0701	TN0001953	Jack Daniel Distillery, Lem Motlow Prop., Inc.	3.083	40[a]
0201	TN0003751	Arnold Engineering Development Center	0.021	30
0401	TN0020508	Decherd City STP	0.5	30
0403	TN0021644	Cowan STP	0.4	30
0103	TN0021806	Monteagle STP, Plant #1	0.25	30
0305	TN0023469	Tullahoma STP	5	30
0701	TN0025101	Lynchburg STP	0.3	30
0201	TN0056430	The University of Tennessee Space Institute	0.0063	40[a]
0103	TN0060372	Monteagle WTP	0.031	40[a]
0701	TN0061191	Lynchburg Water Dept.	0.024	40[a]
0103	TN0064815	Monteagle STP, Plant #2	0.25	30
0201	TN0067202	University of Tennessee Space Institute	0.02	30
0905	TN0074331	TDOT I-65 Welcome Center - Giles County	0.018	30
0601	TN0074853	Huntland WTP	0.166	40[a]
0905	TN0076007	Elkton STP	0.008	10

a = Daily Maximum Limit [mg/L]

7.1.3 Waste Load Allocations for NPDES-Regulated Construction Activities

Certain construction activities are regulated by the State's NPDES program (see Section 6.1.2). As of March 10, 2003, construction activities of one or more acres must be permitted. This includes clearing, grading or excavating that results in an area of disturbance of one or more acres, and activities that result in the disturbance of less than one acre if it is part of a larger common plan of development or sale. Since these construction activities may discharge sediment to surface waters, WLAs are provided for this category of activities. WLAs are established for each subwatershed containing a waterbody identified on the 1998 303(d) list or Proposed Final 2002 303(d) List as impaired due to siltation or habitat alteration (ref. Tables 2 & 3). WLAs are expressed as the required percent reduction in the estimated average annual sediment loading for the impaired subwatershed, relative to the estimated average annual sediment loading of a biologically healthy (reference) subwatershed located in the same Level IV ecoregion (see Table 10).

The WLAs provided to the NPDES regulated construction activities will be implemented as Best Management Practices (BMPs), as specified in NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activit*y. It is not technically feasible to incorporate numeric sediment limits into construction storm water permits at this time. WLAs should not be construed as numeric permit limits. Ambient monitoring may be required for specific discharges to determine compliance with the TMDL for a particular segment.

Properly designed and well-maintained BMPs are expected to provide attainment of WLAs. In some cases, it may be necessary to go beyond standard practices in the application of BMPs to assure compliance with the WLA (see Section 8).

7.1.4 Determination of Waste Load Allocations for NPDES-Regulated Construction Municipal Separate Storm Sewer Systems (MS4s)

Large and medium municipal separate storm sewer systems (MS4s) are currently regulated by the State's NPDES program (see Section 6.1.3). In 2003, small MS4s serving urbanized areas will also be required to obtain an NPDES permit under the Phase II storm water regulations. Since MS4s have the potential to discharge TSS to surface waters, WLAs are specified for these systems. WLAs are established for each subwatershed containing a waterbody identified on the 1998 303(d) list or Proposed Final 2002 303(d) List as impaired due to siltation or habitat alteration (ref. Tables 2 & 3). WLAs are expressed as the required percent reduction in the estimated average annual sediment loading for an impaired subwatershed, relative to the estimated average annual sediment loading of a biologically healthy (reference) subwatershed located in the same Level IV ecoregion (see Table 10).

WLAs provided to NPDES regulated MS4s will be implemented as Best Management Practices (BMPs) as specified in Phase I & II MS4 permits. It is not technically feasible to incorporate numeric sediment limits into MS4 permits at this time. WLAs should not be construed as numeric permit limits. Ambient monitoring may be required for specific discharges to determine compliance with the TMDL for a particular segment. Properly designed and well-maintained BMPs are expected to provide attainment of WLAs. In some cases, it may be necessary to go beyond standard practices in the application of BMPs to assure compliance with the WLA (see Section 8).

7.2 Determination of Load Allocations for Nonpoint Sources

All sources of sediment loading to surface waters not covered by the NPDES program are provided a Load Allocation (LA) in these TMDLs. LAs are established for each subwatershed containing a waterbody identified on the 1998 303(d) list or Proposed Final 2002 303(d) List as impaired due to siltation or habitat alteration (ref. Tables 2 & 3). LAs are expressed as the required percent reduction in the estimated average annual sediment loading for the impaired subwatershed, relative to the estimated average annual sediment loading of a biologically healthy (reference) subwatershed located in the same Level IV ecoregion (see Table 10). Properly designed and well-maintained BMPs will be necessary to assure that LAs are achieved.

7.3 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) in the analysis: a) implicitly incorporate the MOS using conservative model assumptions to develop allocations; or b) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. In these TMDLs, an implicit MOS was incorporated through the use of conservative modeling assumptions. These include:

- Target values based on Level IV ecoregion reference sites. These sites represent the least impacted streams in the ecoregion.

- The use of appropriate ecoregion reference site average annual sediment load as the target value for the calculation of load reductions.

- The use of the sediment delivery process that results in the most sediment transport to surface waters (Method 2 in Appendix A).

7.4 Seasonal Variation

Sediment loading is expected to fluctuate according to the amount and distribution of rainfall. The determination of sediment loads on an average annual basis accounts for these differences through the rainfall erosivity index in the USLE (See Appendix A). This is a statistic calculated from the annual summation of rainfall energy in every storm and its maximum 30-minute intensity.

7.5 Future Sediment TMDLs

As the science and available data for wet weather discharges of sediment continues to grow, more advanced approaches to sediment TMDLs are expected to be developed. These new approaches will be applied, as appropriate, through the adaptive management process to enhance the effectiveness of TMDLs and to provide a sound basis for water quality management decisions. A discussion of U.S. Environmental Protection Agency Region IV's proposed future approach to sediment TMDLs is provided in Appendix C.

Table 10 Percent Reductions in Average Annual Sediment Loading for Impaired Subwatersheds

Subwatershed	Level IV Ecoregion	Target Sediment Load	% Reduction - Avg. Annual Sediment Load		
			TMDL	WLAs (Construction SW & MS4s)	LAs (Nonpoint Sources)
		[lbs/acre/yr]	[%]	[%]	[%]
0103	68a	128.7	61.9	61.9	61.9
0201	71g	356.9	25.8	25.8	25.8
0202	68a	128.7	76.9	76.9	76.9
0205	71g	356.9	35.9	35.9	35.9
0303	71g	356.9	52.7	52.7	52.7
0305	71g	356.9	50.2	50.2	50.2
0401	71g	356.9	36.5	36.5	36.5
0403	71g	356.9	31.8	31.8	31.8
0601	71g	356.9	59.5	59.5	59.5
0701	71h	597.6	70.6	70.6	70.6
0903	71h	597.6	50.5	50.5	50.5
0905	71h	597.6	33.2	33.2	33.2

8.0 IMPLEMENTATION PLAN

8.1 Point Sources

8.1.1 NPDES-Regulated Municipal and Industrial Wastewater Treatment Facilities

Calculations show that TSS discharges from facilities covered under individual NPDES permits account for less than three percent of the total existing average annual sediment loading in impaired subwatersheds in the Upper Elk River Watershed. These TMDLs require that all of these facilities comply with their existing permit requirements. The WLAs for these facilities will be implemented through each facility's NPDES permit.

8.1.2 NPDES Regulated Mine Sites

Discharges from mine sites covered under individual NPDES permits account for less than 2% of the total existing average annual sediment loading in impaired subwatersheds in the Upper Elk River Watershed. These TMDLs require that all of these facilities comply with their existing permit requirements. The WLA for these facilities will be implemented through each facility's NPDES permit.

8.1.3 NPDES-Regulated Construction Storm Water

The WLAs provided to future NPDES-regulated construction activities will be implemented through Best Management Practices (BMPs) as specified in NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activit*y. It is not technically feasible to incorporate numeric sediment limits into permits for these activities at this time. WLAs should <u>not</u> be construed as numeric permit limits.

Construction sites in Tennessee disturbing five acres or more are currently required to obtain coverage under the *General NPDES Permit for Storm Water Discharges Associated With Construction Activit*y (see Appendix E). As of March 10, 2003, construction activities of one or more acres must be permitted as well. This permit requires:

- Development and implementation of a site-specific Storm Water Pollution Prevention Plan (SWPPP) that addresses erosion and sediment control.
- Good engineering and best management practices in the design, installation, and maintenance of erosion and sediment controls.
- Erosion and sediment controls must be designed to function properly in a two-year, 24-hour storm event.

In addition, a number of special requirements in the permit apply to discharges entering waterbodies that have been identified on the 1998 303(d) list, or more recent assessments, as being impaired due to siltation. This includes all waterbodies provided a WLA under these TMDLs. These additional requirements include:

- More frequent (weekly) inspections of erosion and sediment controls.

- Inspections and the condition of erosion and sediment controls must be reported to the Division of Water Pollution Control (DWPC).

- The SWPPP must be submitted to the DWPC prior to disturbing soil at the construction site.

- In order to assure that the WLA is achieved, the application of BMPs that go beyond the typical minimum elements generally undertaken to comply with the General Permit may be necessary.

Strict compliance with the provisions of the *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* can reasonably be expected to achieve reduced sediment loads to streams. The primary challenge for the reduction of sediment loading from construction sites to meet TMDL WLAs is in the effective compliance monitoring of all requirements specified in the permit and timely enforcement against construction sites not found to be in compliance with the permit.

8.1.4 NPDES-Regulated Municipal Separate Storm Sewer Systems (MS4s)

For regulated discharges from municipal separate storm sewer systems, WLAs will be implemented through Phase II MS4 permits. These permits will require the development and implementation of a Storm Water Management Plan (SWMP) that will reduce the discharge of pollutants to the "maximum extent practicable" and not cause or contribute to violations of State water quality standards. The individual permittees will be responsible for identifying the specific BMPs to be applied to attain appropriate reduction in sediment loads. The SWMP will also include a number of programs/activities to identify sources of pollutants in municipal storm water runoff and verify SWMP effectiveness.

8.2 Implementation of Load Allocations for Nonpoint Sources

Reductions of sediment loading from nonpoint sources (NPS) will be achieved using a phased approach. Voluntary, incentive-based mechanisms will be used to implement NPS management measures in order to assure that measurable reductions in sediment loadings can be achieved for the targeted impaired water. Cooperation and active participation by the general public and various industry, business, and environmental groups is critical to successful implementation of TMDLs. Local citizen-led and implemented management measures offer the most efficient and comprehensive avenue for reduction of loading rates from nonpoint sources. TMDL implementation activities will be accomplished within the framework of Tennessee's Watershed Approach (ref: www.state.tn.us/environment/wpc/wshed1.htm).

The Watershed Approach is based on a five-year cycle and encompasses planning, monitoring , assessment, TMDLs, WLAs/LAs, and permit issuance. It relies on participation at the federal, state, local and nongovernmental levels to be successful. The *Upper Elk River Watershed Management Plan* will be developed in 2003 and will describe, in general, the partnerships among government agencies and stakeholder groups and the roles that each play in the effort to improve water quality in the Upper Elk River Watershed, including the reduction of pollutant loading.

Governmental agencies include :

- Natural Resources Conservation Service
- USGS Water Resource Programs—Tennessee District
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- Tennessee Valley Authority
- TDEC - Division of Water Supply
- TDEC Division of Community Assistance
- Tennessee Department of Agriculture
- Tennessee Wildlife Resources Agency

Local stakeholder groups include:

- Tims Ford Lake Council

With respect to the reduction of nonpoint source sediment loading and habitat alteration, government agency and stakeholders should, at a minimum, be directed to:

- Implement and maintain conservation farming, including conservation tillage, contour strips and no till farming.
- Install grass buffer strips along streams.
- Reduce activities within riparian areas
- Minimize road and bridge construction impacts on streams

8.3 Aquatic Resource Alteration

There are a number of stream alteration activities that have the potential to effect sediment loading to surface waters in the Upper Elk River Watershed. In Tennessee, Aquatic Resource Alteration Permits (ARAPs) are required for <u>any</u> alteration of state waters not requiring a federal permit, including:

- Dredging, widening, straightening, or bank stabilization
- Levee construction (if excavation or fill of stream channel is involved)
- Channel relocation
- Flooding, excavating, draining, and/or filling a wetland
- Bridge construction
- Bridge scour repair
- Construction of road or utility line crossings
- Sand and gravel dredging
- Debris removal
- Emergency road repair

Aquatic Resource Alteration Permits are developed in accordance with Tennessee Rule 1200-4-7, *Aquatic Resource Alteration* (TDEC, 2000b) and contain provisions that minimize impacts to surface waters.

8.4 Evaluation of TMDL Effectiveness

The effectiveness of the TMDL will be assessed within the context of the State's rotating watershed management approach. Watershed monitoring and assessment activities will provide information by which the effectiveness of sediment loading reduction measures can be evaluated. Monitoring data, ground-truthing, and source identification actions will enable implementation of particular types of BMPs to be directed to specific areas in the subwatersheds. These TMDLs will be revaluated during subsequent watershed cycles and revised as required to assure attainment of applicable water quality standards.

9.0 PUBLIC PARTICIPATION

In accordance with 40 CFR §130.7, the proposed sediment TMDLs for the Upper Elk River Watershed will be placed on Public Notice for a 35-day period and comments solicited. Steps that will be taken in this regard include:

1) Notice of the proposed TMDLs will be posted on the Tennessee Department of Environment and Conservation website. The notice will invite public and stakeholder comments and provide a link to a downloadable version of the TMDL document.

2) Notice of the availability of the proposed TMDLs (similar to the website announcement) will be included in one of the NPDES permit Public Notice mailings.

3) A letter will be sent to point source facilities in the Upper Elk River Watershed that are permitted to discharge treated total suspended solids (TSS) advising them of the proposed sediment TMDLs and their availability on the TDEC website. The letter will also state that a written copy of the draft TMDL document will be provided on request.

4) A draft copy of the proposed sediment TMDLs was sent to the City of Tullahoma and Tennessee Department of Transportation (TDOT). Tullahoma and TDOT will be issued MS4 permits under the Phase II storm water regulations.

5) Meetings with the public or individual stakeholders will be held if needed.

10.0 FURTHER INFORMATION

Further information concerning Tennessee's TMDL program can be found on the Internet at the Tennessee Department of Environment and Conservation website:

www.state.tn.us/environment/wpc/tmdl.htm

Technical questions regarding these TMDLs should be directed to the following members of the Division of Water Pollution Control staff:

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e-mail: Regan.McGahen@state.tn.us

Sherry H. Wang, Ph.D., Watershed Management Section
e-mail: Sherry.Wang@state.tn.us

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APPENDIX A

Watershed Sediment Loading Model

WATERSHED SEDIMENT LOADING MODEL

Determination of target average annual sediment loading values for reference watersheds and the sediment loading analysis of waterbodies impaired for siltation/habitat alteration was accomplished utilizing the Watershed Characterization System (WCS) Sediment Tool (v.2.6). WCS is an Arcview geographic information system (GIS) based program developed by USEPA Region IV to facilitate watershed characterization and TMDL development. WCS consists of an initial set of spatial and tabular watershed data, stored in a database, and allows the incorporation of additional data when available. It provides a number of reporting tools and data management utilities to allow users to analyze and summarize data. Program extensions, such as the sediment tool, expand the functionality of WCS to include modeling and other more rigorous forms of data analysis (USEPA, 2001).

Sediment Analysis

The Sediment Tool is an extension of WCS that utilizes available GIS coverages (land use, soils, elevations, roads, etc), the Universal Soil Loss Equation (USLE) to calculate potential erosion, and sediment delivery equations to calculate sediment delivery to the stream network. The following tasks can be performed:

- Estimate extent and distribution of potential soil erosion in the watershed.
- Estimate potential sediment delivery to receiving waterbodies.
- Evaluate effects of land use, BMPs, and road network on erosion and sediment delivery.

The Sediment Tool can also be used to evaluate different scenarios, such as the effects of changing land uses and implementation of BMPs, by the adjustment of certain input parameters. Parameters that may be adjusted include:

- Conservation management and erosion control practices
- Changes in land use
- Implementation of Best Management Practices (BMPs)
- Addition/Deletion of roads

Sediment analyses can be performed for single or multiple watersheds.

Universal Soil Loss Equation

Erosion potential is based on the Universal Soil Loss Equation (USLE), developed by Agriculture Research Station (ARS) scientists W. Wischmeier and D. Smith. It has been the most widely accepted and utilized soil loss equation for over 30 years. The USLE is a method to predict the average annual soil loss on a field slope based on rainfall pattern, soil type, topography, crop system, and management practices. The USLE only predicts the amount of soil loss resulting from sheet or rill erosion on a single slope and does not account for soil losses that might occur from gully, wind, or tillage erosion. Designed as a model for use with certain cropping and management systems, it is also applicable to non-agricultural situations (OMAFRA 2000). While the USLE can be used to estimate long-term average annual soil loss, it cannot be applied to a specific year or a specific storm. Based on its long history of use and wide acceptance by the forestry and agricultural communities, the USLE was considered to be an adequate tool for estimating the relative long-term average annual soil erosion of watersheds and evaluating the effects of land use changes and implementation of BMP measures.

Soil loss from sheet and rill erosion is primarily due to detachment of soil particles during rain events. It is the cause of the majority of soil loss for lands associated with crop production, grazing areas, construction sites, mine sites, logging areas, and unpaved roads. In the USLE, five major factors are used to calculate the soil loss for a given area. Each factor is the numerical estimate of a specific condition that affects the severity of soil erosion in that area. The USLE for estimating average annual soil erosion is expressed as:

$$A = R \times K \times LS \times C \times P$$

where:

A = average annual soil loss in tons per acre
R = rainfall erosivity index
K = soil erodibility factor
LS = topographic factor - L is for slope length and S is for slope
C = crop/vegetation & management factor
P = conservation practice factor

Evaluating the factors in USLE:

R - Rainfall Erosivity Index

The rainfall erosivity index describes the kinetic energy generated by the frequency and intensity of the rainfall. It is statistically calculated from the annual summation of rainfall energy in every storm, which correlates to the raindrop size, times its maximum 30-minute intensity. This index varies with geography.

K - Soil Erodibility Factor

This factor quantifies the cohesive or bonding character of the soil and its ability to resist detachment and transport during a rainfall event. The soil erodibility factor is a function of soil type.

LS - Topographic Factor

The topographic factor represents the effect of slope length and slope steepness on erosion. Steeper slopes produce higher overland flow velocities. Longer slopes accumulate runoff from larger areas and also result in higher flow velocities. For convenience L and S are frequently lumped into a single term.

C – Crop/Vegetation & Management Factor

The crop/vegetation and management factor represents the effect that ground cover conditions, soil conditions, and general management practices have on soil erosion. It is the most computationally complicated of USLE factors and incorporates the effects of: tillage management, crop type, cropping history (rotation), and crop yield.

P - Conservation Practice Factor

The conservation practice factor represents the effects on erosion of Best Management Practices (BMPs) such as contour farming, strip cropping and terracing.

Estimates of the USLE parameters, and thus the soil erosion as computed from the USLE, are provided by the Natural Resources Conservation Service's (NRCS) National Resources Inventory (NRI) 1994. The NRI database contains information of the status, condition, and trend of soil, water and related resources collected from approximately 800,000 sampling points across the country.

The soil losses from the erosion processes described above are localized losses and not the total amount of sediment that reaches the stream. The fraction of the soil lost in the field that is eventually delivered to the stream depends on several factors. These include, the distance of the source area from the stream, the size of the drainage area, and the intensity and frequency of rainfall. Soil losses along the riparian areas will be delivered into the stream with runoff-producing rainfall.

Sediment Modeling Methodology

Using WCS and the Sediment Tool, average annual sediment loading to surface waters was modeled according to the following procedures:

1. A WCS project was setup for the watershed that is the subject of these TMDLs. Additional data layers required for sediment analysis were generated or imported into the project. These included:

   DEM (grid) – The Digital Elevation Model (DEM) layers that come with the basic WCS distribution system are shapefiles of coarse resolution (300x300m). A higher resolution DEM grid layer (30x30m) is required. The National Elevation Dataset (NED) is available from the USGS website and the coverage for the watershed (8-digit HUC) was imported into the project.

   Road – A road layer is needed as a shape file and requires additional attributes such as road type, road practice, and presence of side ditches. If these attributes are not provided, the Sediment Tool automatically assigns default values: road type - secondary paved roads, side ditches present, and no road practices. This data layer was obtained from ESRI for areas in the watershed.

   Soil – The SSURGO (1:24k) soil data may be imported into the WCS project if higher-resolution soil data is required for the estimation of potential erosion. If the SSURGO soil database is not available, the system uses the STATSGO Soil data (1:250k) by default.

   MRLC Land Use – The Multi-Resolution Land Characteristic (MRLC) data set for the watershed is provided with the WCS package, but must be imported into the project.

2. Using WCS, the entire watershed was delineated into 37 subwatersheds corresponding to USGS 12-digit Hydrologic Unit Codes (HUCs). These delineations are shown in Figure 6. Land use distribution for these delineations is summarized in Appendix B. All of the sediment analyses were performed on the basis of these drainage areas.

The following steps are accomplished using the WCS Sediment Tool:

3. For a selected watershed or subwatershed, a sediment project is set up in a new view that contains the data layers that will be subsequently used to calculate erosion and sediment delivery.

4. A stream grid for each delineated subwatershed was created by etching a stream coverage, based on Reach File v. 3 (Rf3) or National Hydrology Dataset (NHD), to the DEM grid.

5. For each 30 by 30 meter grid cell within the subwatershed, the Sediment Tool calculates the potential erosion using the USLE based on the specific cell characteristics. The model then calculates the potential sediment delivery to the stream grid network. Sediment delivery can be calculated using one of the four available sediment delivery equations:

   - Distance-based equation (Sun and McNulty 1998)
     Mad = M * (1-0.97 * D/L)
     where: Mad = mass moved (tons/acre/yr)
     M = sediment mass eroded (ton)
     D = least cost distance from a cell to the nearest stream grid (ft)
     L = maximum distance the sediment may travel (ft)

   - Distance Slope-based equation (Yagow et al. 1998)
     DR = exp(-0.4233 * L * So)
     So = exp (-16.1 * r/L+ 0.057)) - 0.6
     where: DR = sediment delivery ration
     L = distance to the stream (m)
     r = relief to the stream (m)

   - Area-based equation (USDASCS 1983)
     $DR = 0.417762 * A^{(-0.134958)} - 1.27097$, DR <= 1.0
     where: DR = sediment delivery ratio
     A = area (sq miles)

   - WEEP-based regression equation (Swift 2000)
     $Z = 0.9004 - 0.1341 * X^2 + X^3 - 0.0399 * Y + 0.0144 * Y^2 + 0.00308 * Y^3$
     where: Z = percent of source sediment passing to the next grid cell
     X = cumulative distance down slope (X > 0)
     Y = percent slope in the grid cell (Y > 0)

   The distance slope based equation (Yagow et al. 1998) was selected to simulate sediment delivery in the Upper Elk River Watershed.

6. The total sediment delivered upstream of each subwatershed "pour point" is calculated. The sediment analysis provides the calculations for six new parameters:

   - Source Erosion – estimated erosion from each grid cell due to the land cover
   - Road Erosion – estimated erosion from each grid cell representing a road
   - Composite Erosion – composite of the source and road erosion layers
   - Source Sediment – estimated fraction of the soil erosion from each grid cell that reaches the stream (sediment delivery)
   - Road Sediment – estimated fraction of the road erosion from each grid cell that reaches the stream
   - Composite Sediment – composite of the source and erosion sediment layers

   The sediment delivery can be calculated based on the composite sediment, road sediment, or source sediment layer. The sources of sediment by each land use type is determined showing the types of land use, the acres of each type of land use, and the tons of sediment estimated to be generated from each land use.

7. For each subwatershed of interest, the resultant sediment load calculation is expressed as a long-term average annual soil loss expressed in pounds per year calculated for the rainfall erosivity index (R). This statistic is calculated from the annual summation of rainfall energy in every storm (correlates with raindrop size) times its maximum 30-minute intensity.

   Calculated erosion, sediment loads delivered to surface waters, and unit loads (per unit area) for subwatersheds that contain 303(d) listed waters are summarized in Tables A-1, A-2, and A-3, respectively. Similar information for subwatersheds that do not contain 303(d) listed waters are summarized in Tables A-4, A-5, and A-6.

Table A-1 Calculated Erosion - Subwatersheds With Waterbodies on the 1998 303(d) List and/or Proposed Final 2002 303(d) List

Subwatershed	EROSION				
	Source [tons/yr]	Road [tons/yr]	Total [tons/yr]	%Source	%Road
60300030103	5242	3303	8545	61.3%	38.7%
60300030201	25007	4465	29471	84.9%	15.1%
60300030202	7352	909	8261	89.0%	11.0%
60300030205	22090	3159	25249	87.5%	12.5%
60300030303	6829	589	7417	92.1%	7.9%
60300030305	17255	6592	23847	72.4%	27.6%
60300030401	42504	9458	51963	81.8%	18.2%
60300030403	12394	2830	15225	81.4%	18.6%
60300030601	31689	4073	35762	88.6%	11.4%
60300030701	70723	8962	79685	88.8%	11.2%
60300030903	48511	10195	58706	82.6%	17.4%
60300030905	34413	10995	45408	75.8%	24.2%

Table A-2 Calculated Sediment Delivery to Surface Waters - Subwatersheds With Waterbodies on the 1998 303(d) List and/or Proposed Final 2002 303(d) List

Subwatershed	***SEDIMENT***				
	Source [tons/yr]	**Road [tons/yr]**	**Total [tons/yr]**	**%Source**	**%Road**
60300030103	2110	1508	3618	58.3%	41.7%
60300030201	7683	1971	9654	79.6%	20.4%
60300030202	2220	351	2571	86.4%	13.6%
60300030205	7065	1237	8301	85.1%	14.9%
60300030303	1958	175	2134	91.8%	8.2%
60300030305	6824	2843	9667	70.6%	29.4%
60300030401	8831	3678	12509	70.6%	29.4%
60300030403	3414	420	3834	89.0%	11.0%
60300030601	11943	1694	13637	87.6%	12.4%
60300030701	30267	5633	35900	84.3%	15.7%
60300030903	15180	6110	21290	71.3%	28.7%
60300030905	12460	6544	19004	65.6%	34.4%

Table A-3 Unit Loads - Subwatersheds With Waterbodies on the 1998 303(d) List and/or Proposed Final 2002 303(d) List

Subwatershed	*UNIT LOADS*		
	Erosion	Sediment	
	[tons/ac/yr]	[tons/ac/yr]	[lbs/ac/yr]
60300030103	0.399	0.169	337
60300030201	0.734	0.240	481
60300030202	0.894	0.278	556
60300030205	0.847	0.279	557
60300030303	1.311	0.377	754
60300030305	0.885	0.359	717
60300030401	1.168	0.281	562
60300030403	1.039	0.262	523
60300030601	1.157	0.441	882
60300030701	2.257	1.017	2034
60300030903	1.666	0.604	1208
60300030905	1.069	0.448	895

Table A-4 Calculated Erosion - Subwatersheds Without Waterbodies on the 1998 303(d) List or Proposed Final 2002 303(d) List

Subwatershed	*EROSION*				
	Source [tons/yr]	Road [tons/yr]	Total [tons/yr]	%Source	%Road
60300030101	4295	1304	5599	76.7%	23.3%
60300030102	1314	1568	2882	45.6%	54.4%
60300030203	3437	7579	11016	31.2%	68.8%
60300030204	31997	985	32982	97.0%	3.0%
60300030301	20758	5243	26002	79.8%	20.2%
60300030302	2115	1277	3392	62.3%	37.7%
60300030304	2992	1062	4054	73.8%	26.2%
60300030306	6784	820	7604	89.2%	10.8%
60300030307	7487	843	8330	89.9%	10.1%
60300030308	15794	4912	20706	76.3%	23.7%
60300030309	9203	1995	11199	82.2%	17.8%
60300030402	6682	905	7587	88.1%	11.9%
60300030501	27569	4504	32074	86.0%	14.0%
60300030502	2744	668	3412	80.4%	19.6%
60300030503	2845	2126	4971	57.2%	42.8%
60300030504	38695	9145	47840	80.9%	19.1%
60300030505	15730	6019	21748	72.3%	27.7%
60300030506	34610	7691	42301	81.8%	18.2%
60300030602	41150	4724	45873	89.7%	10.3%
60300030702	26561	5549	32110	82.7%	17.3%
60300030801	35188	7200	42387	83.0%	17.0%
60300030802	20998	4058	25056	83.8%	16.2%
60300030901	29570	5261	34831	84.9%	15.1%
60300030902	21413	6614	28027	76.4%	23.6%
60300030904	22205	13862	36066	61.6%	38.4%

Table A-5 Calculated Sediment Delivery to Surface Waters- Subwatersheds Without Waterbodies on the 1998 303(d) List or Proposed Final 2002 303(d) List

Subwatershed	***SEDIMENT***				
	Source [tons/yr]	**Road [tons/yr]**	**Total [tons/yr]**	**%Source**	**%Road**
60300030101	1775	696	2471	71.8%	28.2%
60300030102	580	724	1304	44.5%	55.5%
60300030203	2631	1650	4280	61.5%	38.5%
60300030204	11331	215	11546	98.1%	1.9%
60300030301	9372	2762	12134	77.2%	22.8%
60300030302	893	625	1519	58.8%	41.2%
60300030304	1574	528	2102	74.9%	25.1%
60300030306	2293	404	2697	85.0%	15.0%
60300030307	1678	274	1952	85.9%	14.1%
60300030308	5826	2879	8705	66.9%	33.1%
60300030309	3602	842	4444	81.0%	19.0%
60300030402	2704	381	3085	87.7%	12.3%
60300030501	11493	2520	14013	82.0%	18.0%
60300030502	1333	289	1622	82.2%	17.8%
60300030503	1173	1388	2561	45.8%	54.2%
60300030504	12379	4908	17287	71.6%	28.4%
60300030505	5567	3154	8722	63.8%	36.2%
60300030506	11666	4949	16615	70.2%	29.8%
60300030602	17170	2395	19565	87.8%	12.2%
60300030702	10269	3712	13980	73.5%	26.5%
60300030801	13723	4341	18064	76.0%	24.0%
60300030802	8042	2043	10085	79.7%	20.3%
60300030901	10387	2540	12927	80.4%	19.6%
60300030902	8613	3943	12556	68.6%	31.4%
60300030904	9266	8770	18036	51.4%	48.6%

Table A-6 Unit Loads - Subwatersheds Without Waterbodies on the 1998 303(d) List or Proposed Final 2002 303(d) List

Subwatershed	*UNIT LOADS*		
	Erosion	Sediment	
	[tons/ac/yr]	[tons/ac/yr]	[lbs/ac/yr]
60300030101	0.243	0.107	214
60300030102	0.202	0.092	183
60300030203	0.837	0.325	650
60300030204	2.163	0.757	1514
60300030301	1.029	0.480	960
60300030302	0.527	0.236	472
60300030304	0.766	0.397	794
60300030306	1.369	0.486	971
60300030307	1.092	0.256	512
60300030308	1.152	0.484	969
60300030309	1.641	0.651	1302
60300030402	0.904	0.368	736
60300030501	1.946	0.850	1700
60300030502	1.090	0.518	1037
60300030503	0.843	0.434	869
60300030504	1.332	0.481	963
60300030505	0.939	0.377	753
60300030506	1.394	0.548	1095
60300030602	1.886	0.804	1608
60300030702	1.127	0.491	981
60300030801	1.027	0.438	875
60300030802	0.949	0.382	764
60300030901	1.468	0.545	1090
60300030902	0.872	0.390	781
60300030904	0.802	0.401	803

APPENDIX B

Subwatershed Land Use

Table B-1 Upper Elk River Watershed – Subwatershed Land Use Distribution

Landuse	Subwatershed											
	0101		0102		0103		0201		0202		0203	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Deciduous Forest	18848.0	81.7%	11158.0	78.3%	12555.0	58.6%	13558.0	33.8%	4724.0	51.2%	6421.0	48.8%
Emergent Herbaceous Wetlands	0.0	0.0%	8.0	0.1%	36.0	0.2%	164.0	0.4%	0.0	0.0%	0.0	0.0%
Evergreen Forest	171.0	0.7%	942.0	6.6%	791.0	3.7%	1227.0	3.1%	29.0	0.3%	295.0	2.2%
High Intensity Commercial / Industrial / Transportation	11.0	0.0%	24.0	0.2%	190.0	0.9%	264.0	0.7%	55.0	0.6%	21.0	0.2%
High Intensity Residential	0.0	0.0%	0.0	0.0%	7.0	0.0%	5.0	0.0%	0.0	0.0%	0.0	0.0%
Low Intensity Residential	10.0	0.0%	22.0	0.2%	153.0	0.7%	139.0	0.3%	11.0	0.1%	34.0	0.3%
Mixed Forest	896.0	3.9%	998.0	7.0%	1778.0	8.3%	1672.0	4.2%	320.0	3.5%	1370.0	10.4%
Open Water	5.0	0.0%	75.0	0.5%	9.0	0.0%	3906.0	9.7%	91.0	1.0%	12.0	0.1%
Other Grasses (Urban / Recreational)	1.0	0.0%	6.0	0.0%	20.0	0.1%	123.0	0.3%	0.0	0.0%	12.0	0.1%
Pasture / Hay	2064.0	9.0%	557.0	3.9%	3084.0	14.4%	7556.0	18.8%	1611.0	17.4%	1816.0	13.8%
Quarries / Strip Mines / Gravel Pits	0.0	0.0%	0.0	0.0%	0.0	0.0%	22.0	0.1%	52.0	0.6%	0.0	0.0%
Row Crops	994.0	4.3%	225.0	1.6%	2004.0	9.3%	8772.0	21.9%	2310.0	25.0%	3171.0	24.1%
Transitional	57.0	0.2%	78.0	0.5%	137.0	0.6%	181.0	0.5%	26.0	0.3%	2.0	0.0%
Woody Wetlands	0.0	0.0%	152.0	1.1%	672.0	3.1%	2556.0	6.4%	5.0	0.1%	3.0	0.0%
Total	23057.0	100.0%	14245.0	100.0%	21436.0	100.0%	40145.0	100.0%	9234.0	100.0%	13157.0	100.0%

Table B-1 (cont.) Upper Elk River Watershed – Subwatershed Land Use Distribution

Landuse	Subwatershed											
	0204		0205		0301		0302		0303		0304	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Deciduous Forest	6736.0	44.2%	10530.0	35.4%	5525.0	21.9%	3700.0	57.6%	213.0	3.8%	2873.0	54.3%
Emergent Herbaceous Wetlands	14.0	0.1%	79.0	0.3%	119.0	0.5%	0.0	0.0%	12.0	0.2%	0.0	0.0%
Evergreen Forest	109.0	0.7%	495.0	1.7%	536.0	2.1%	942.0	14.7%	77.0	1.4%	151.0	2.9%
High Intensity Commercial / Industrial / Transportation	68.0	0.4%	293.0	1.0%	279.0	1.1%	1.0	0.0%	40.0	0.7%	97.0	1.8%
High Intensity Residential	0.0	0.0%	0.0	0.0%	26.0	0.1%	0.0	0.0%	0.0	0.0%	11.0	0.2%
Low Intensity Residential	35.0	0.2%	67.0	0.2%	378.0	1.5%	2.0	0.0%	29.0	0.5%	159.0	3.0%
Mixed Forest	530.0	3.5%	948.0	3.2%	1914.0	7.6%	494.0	7.7%	213.0	3.8%	388.0	7.3%
Open Water	30.0	0.2%	50.0	0.2%	5593.0	22.1%	2.0	0.0%	24.0	0.4%	48.0	0.9%
Other Grasses (Urban / Recreational)	0.0	0.0%	77.0	0.3%	205.0	0.8%	0.0	0.0%	2.0	0.0%	114.0	2.2%
Pasture / Hay	2971.0	19.5%	7586.0	25.5%	5198.0	20.6%	728.0	11.3%	2440.0	43.2%	884.0	16.7%
Quarries / Strip Mines / Gravel Pits	95.0	0.6%	0.0	0.0%	0.0	0.0%	25.0	0.4%	0.0	0.0%	0.0	0.0%
Row Crops	4403.0	28.9%	8232.0	27.6%	4068.0	16.1%	343.0	5.3%	2190.0	38.7%	554.0	10.5%
Transitional	2.0	0.0%	26.0	0.1%	49.0	0.2%	119.0	1.9%	6.0	0.1%	13.0	0.2%
Woody Wetlands	248.0	1.6%	1404.0	4.7%	1379.0	5.5%	71.0	1.1%	408.0	7.2%	0.0	0.0%
Total	15241.0	100.0%	29787.0	100.0%	25269.0	100.0%	6427.0	100.0%	5654.0	100.0%	5292.0	100.0%

Table B-1 (cont.) Upper Elk River Watershed – Subwatershed Land Use Distribution

Landuse	Subwatershed											
	0305		0306		0307		0308		0309		0401	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Deciduous Forest	11676.0	43.3%	2157.0	38.9%	1631.0	21.4%	9497.0	52.9%	3543.0	52.0%	13323.0	30.0%
Emergent Herbaceous Wetlands	1.0	0.0%	0.0	0.0%	25.0	0.3%	0.0	0.0%	0.0	0.0%	174.0	0.4%
Evergreen Forest	528.0	2.0%	81.0	1.5%	181.0	2.4%	285.0	1.6%	129.0	1.9%	1146.0	2.6%
High Intensity Commercial / Industrial / Transportation	871.0	3.2%	34.0	0.6%	23.0	0.3%	110.0	0.6%	26.0	0.4%	518.0	1.2%
High Intensity Residential	334.0	1.2%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	283.0	0.6%
Low Intensity Residential	1129.0	4.2%	70.0	1.3%	17.0	0.2%	80.0	0.4%	16.0	0.2%	1112.0	2.5%
Mixed Forest	1487.0	5.5%	421.0	7.6%	457.0	6.0%	1515.0	8.4%	729.0	10.7%	3569.0	8.0%
Open Water	95.0	0.4%	386.0	7.0%	347.0	4.5%	1496.0	8.3%	947.0	13.9%	883.0	2.0%
Other Grasses (Urban / Recreational)	1153.0	4.3%	6.0	0.1%	0.0	0.0%	56.0	0.3%	0.0	0.0%	819.0	1.8%
Pasture / Hay	5667.0	21.0%	1295.0	23.3%	2329.0	30.5%	3394.0	18.9%	853.0	12.5%	11434.0	25.7%
Quarries / Strip Mines / Gravel Pits	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	77.0	0.2%
Row Crops	3736.0	13.9%	1089.0	19.6%	2065.0	27.1%	1520.0	8.5%	577.0	8.5%	9347.0	21.0%
Transitional	110.0	0.4%	11.0	0.2%	0.0	0.0%	12.0	0.1%	0.0	0.0%	18.0	0.0%
Woody Wetlands	154.0	0.6%	0.0	0.0%	552.0	7.2%	0.0	0.0%	0.0	0.0%	1753.0	3.9%
Total	26941.0	100.0%	5550.0	100.0%	7627.0	100.0%	17965.0	100.0%	6820.0	100.0%	44456.0	100.0%

Table B-1 (cont.) Upper Elk River Watershed – Subwatershed Land Use Distribution

Landuse	Subwatershed											
	0402		0403		0501		0502		0503		0504	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Deciduous Forest	4255.0	50.7%	2883.0	19.7%	5788.0	35.1%	1522.0	48.6%	3085.0	52.4%	14118.0	39.3%
Emergent Herbaceous Wetlands	2.0	0.0%	19.0	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Evergreen Forest	145.0	1.7%	528.0	3.6%	596.0	3.6%	64.0	2.0%	247.0	4.2%	2462.0	6.9%
High Intensity Commercial / Industrial / Transportation	20.0	0.2%	104.0	0.7%	24.0	0.1%	12.0	0.4%	0.0	0.0%	29.0	0.1%
High Intensity Residential	0.0	0.0%	45.0	0.3%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Low Intensity Residential	18.0	0.2%	217.0	1.5%	12.0	0.1%	13.0	0.4%	3.0	0.1%	41.0	0.1%
Mixed Forest	595.0	7.1%	1310.0	8.9%	2503.0	15.2%	272.0	8.7%	949.0	16.1%	6972.0	19.4%
Open Water	3.0	0.0%	207.0	1.4%	355.0	2.2%	0.0	0.0%	0.0	0.0%	522.0	1.5%
Other Grasses (Urban / Recreational)	0.0	0.0%	205.0	1.4%	6.0	0.0%	12.0	0.4%	0.0	0.0%	0.0	0.0%
Pasture / Hay	1704.0	20.3%	4942.0	33.7%	5565.0	33.8%	753.0	24.1%	1504.0	25.5%	8507.0	23.7%
Quarries / Strip Mines / Gravel Pits	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Row Crops	1495.0	17.8%	3925.0	26.8%	1550.0	9.4%	481.0	15.4%	103.0	1.7%	3077.0	8.6%
Transitional	11.0	0.1%	9.0	0.1%	0.0	0.0%	0.0	0.0%	0.0	0.0%	171.0	0.5%
Woody Wetlands	138.0	1.6%	259.0	1.8%	83.0	0.5%	1.0	0.0%	0.0	0.0%	0.0	0.0%
Total	8386.0	100.0%	14653.0	100.0%	16482.0	100.0%	3130.0	100.0%	5891.0	100.0%	35899.0	100.0%

Table B-1 (cont.) Upper Elk River Watershed – Subwatershed Land Use Distribution

Landuse	Subwatershed											
	0505		0506		0601		0602		0701		0702	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Deciduous Forest	5492.0	23.7%	10459.0	34.5%	9636.0	31.2%	7146.0	29.4%	10949.0	31.0%	9367.0	32.9%
Emergent Herbaceous Wetlands	0.0	0.0%	0.0	0.0%	26.0	0.1%	3.0	0.0%	0.0	0.0%	0.0	0.0%
Evergreen Forest	2165.0	9.4%	2512.0	8.3%	757.0	2.4%	586.0	2.4%	2748.0	7.8%	2107.0	7.4%
High Intensity Commercial / Industrial / Transportation	264.0	1.1%	180.0	0.6%	138.0	0.4%	46.0	0.2%	100.0	0.3%	8.0	0.0%
High Intensity Residential	104.0	0.4%	72.0	0.2%	9.0	0.0%	1.0	0.0%	9.0	0.0%	1.0	0.0%
Low Intensity Residential	495.0	2.1%	394.0	1.3%	313.0	1.0%	122.0	0.5%	98.0	0.3%	32.0	0.1%
Mixed Forest	4302.0	18.6%	6373.0	21.0%	2594.0	8.4%	2290.0	9.4%	6086.0	17.2%	5625.0	19.7%
Open Water	427.0	1.8%	5.0	0.0%	84.0	0.3%	36.0	0.1%	8.0	0.0%	4.0	0.0%
Other Grasses (Urban / Recreational)	407.0	1.8%	203.0	0.7%	200.0	0.6%	84.0	0.3%	28.0	0.1%	2.0	0.0%
Pasture / Hay	7557.0	32.7%	8478.0	28.0%	8583.0	27.8%	7820.0	32.2%	11896.0	33.7%	9881.0	34.7%
Quarries / Strip Mines / Gravel Pits	0.0	0.0%	44.0	0.1%	0.0	0.0%	0.0	0.0%	56.0	0.2%	0.0	0.0%
Row Crops	1921.0	8.3%	1608.0	5.3%	8086.0	26.2%	6116.0	25.2%	3316.0	9.4%	1447.0	5.1%
Transitional	10.0	0.0%	1.0	0.0%	46.0	0.1%	9.0	0.0%	2.0	0.0%	12.0	0.0%
Woody Wetlands	0.0	0.0%	0.0	0.0%	431.0	1.4%	59.0	0.2%	0.0	0.0%	0.0	0.0%
Total	23144.0	100.0%	30329.0	100.0%	30903.0	100.0%	24318.0	100.0%	35296.0	100.0%	28486.0	100.0%

Table B-1 (cont.) Upper Elk River Watershed – Subwatershed Land Use Distribution

Landuse	Subwatershed											
	0801		0802		0901		0902		0903		0904	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Deciduous Forest	13014.0	31.5%	4314.0	16.4%	4127.0	17.4%	8917.0	27.7%	11788.0	33.5%	20302.0	45.2%
Emergent Herbaceous Wetlands	0.0	0.0%	2.0	0.0%	0.0	0.0%	0.0	0.0%	11.0	0.0%	8.0	0.0%
Evergreen Forest	2668.0	6.5%	2538.0	9.6%	2388.0	10.1%	3118.0	9.7%	1969.0	5.6%	2305.0	5.1%
High Intensity Commercial / Industrial / Transportation	71.0	0.2%	57.0	0.2%	21.0	0.1%	11.0	0.0%	34.0	0.1%	194.0	0.4%
High Intensity Residential	7.0	0.0%	7.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	1.0	0.0%
Low Intensity Residential	118.0	0.3%	90.0	0.3%	18.0	0.1%	28.0	0.1%	99.0	0.3%	50.0	0.1%
Mixed Forest	8904.0	21.6%	5155.0	19.5%	4529.0	19.1%	7685.0	23.9%	6028.0	17.1%	7696.0	17.1%
Open Water	2.0	0.0%	20.0	0.1%	455.0	1.9%	8.0	0.0%	417.0	1.2%	77.0	0.2%
Other Grasses (Urban / Recreational)	79.0	0.2%	88.0	0.3%	4.0	0.0%	0.0	0.0%	20.0	0.1%	35.0	0.1%
Pasture / Hay	13385.0	32.4%	11018.0	41.8%	8566.0	36.1%	9991.0	31.1%	10935.0	31.0%	12936.0	28.8%
Quarries / Strip Mines / Gravel Pits	0.0	0.0%	32.0	0.1%	45.0	0.2%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Row Crops	2900.0	7.0%	2685.0	10.2%	3237.0	13.6%	2363.0	7.4%	3913.0	11.1%	1331.0	3.0%
Transitional	0.0	0.0%	36.0	0.1%	328.0	1.4%	0.0	0.0%	7.0	0.0%	0.0	0.0%
Woody Wetlands	124.0	0.3%	336.0	1.3%	0.0	0.0%	17.0	0.1%	0.0	0.0%	0.0	0.0%
Total	41272.0	100.0%	26378.0	100.0%	23718.0	100.0%	32138.0	100.0%	35221.0	100.0%	44935.0	100.0%

Table B-1 (cont.) Upper Elk River Watershed – Subwatershed Land Use Distribution

Landuse	Subwatershed 0905	
	[acres]	[%]
Bare Rock/Sand	0.0	0.0%
Deciduous Forest	15711.0	37.0%
Emergent Herbaceous Wetlands	161.0	0.4%
Evergreen Forest	1538.0	3.6%
High Intensity Commercial / Industrial / Transportation	178.0	0.4%
High Intensity Residential	13.0	0.0%
Low Intensity Residential	164.0	0.4%
Mixed Forest	5276.0	12.4%
Open Water	656.0	1.5%
Other Grasses (Urban / Recreational)	21.0	0.0%
Pasture / Hay	15042.0	35.4%
Quarries / Strip Mines / Gravel Pits	0.0	0.0%
Row Crops	3604.0	8.5%
Transitional	40.0	0.1%
Woody Wetlands	42.0	0.1%
Total	42446.0	100.0%

Table B-2 Level IV Ecoregion Reference Site Drainage Area Land Use Distribution

Landuse	Ecosite Subwatershed											
	ECO68A01		ECO68A03		ECO68A08		ECO68A13		ECO68A20		ECO68A26	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Deciduous Forest	1427.0	38.4%	3536.0	32.7%	46284.0	46.8%	4070.0	45.5%	4550.0	61.6%	20301.0	50.9%
Emergent Herbaceous Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	1.0	0.0%	0.0	0.0%	0.0	0.0%
Evergreen Forest	921.0	24.8%	3011.0	27.8%	15790.0	16.0%	2365.0	26.4%	519.0	7.0%	6396.0	16.0%
High Intensity Commercial / Industrial / Transportation	0.0	0.0%	2.0	0.0%	176.0	0.2%	0.0	0.0%	3.0	0.0%	136.0	0.3%
High Intensity Residential	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	4.0	0.0%
Low Intensity Residential	0.0	0.0%	11.0	0.1%	258.0	0.3%	1.0	0.0%	25.0	0.3%	107.0	0.3%
Mixed Forest	1369.0	36.8%	3977.0	36.7%	24815.0	25.1%	942.0	10.5%	2217.0	30.0%	10817.0	27.1%
Open Water	0.0	0.0%	0.0	0.0%	73.0	0.1%	9.0	0.1%	0.0	0.0%	182.0	0.5%
Other Grasses (Urban / Recreational)	0.0	0.0%	3.0	0.0%	236.0	0.2%	0.0	0.0%	10.0	0.1%	201.0	0.5%
Pasture / Hay	0.0	0.0%	259.0	2.4%	9207.0	9.3%	501.0	5.6%	9.0	0.1%	1317.0	3.3%
Quarries / Strip Mines / Gravel Pits	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	68.0	0.2%
Row Crops	0.0	0.0%	28.0	0.3%	1564.0	1.6%	40.0	0.4%	7.0	0.1%	219.0	0.5%
Transitional	0.0	0.0%	0.0	0.0%	501.0	0.5%	725.0	8.1%	48.0	0.6%	175.0	0.4%
Woody Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	292.0	3.3%	0.0	0.0%	0.0	0.0%
Total	3717.0	100.0%	10827.0	100.0%	98904.0	100.0%	8946.0	100.0%	7388.0	100.0%	39923.0	100.0%

Table B-2 (Cont.) Level IV Ecoregion Reference Site Drainage Area Land Use Distribution

Landuse	Ecosite Subwatershed									
	ECO68A27		ECO68A28		ECO68C12		ECO68C13		ECO68C15	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Deciduous Forest	6654.0	56.2%	10209.0	63.7%	518.0	64.0%	1935.0	73.7%	11337.0	80.4%
Emergent Herbaceous Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Evergreen Forest	1485.0	12.5%	1487.0	9.3%	48.0	5.9%	81.0	3.1%	878.0	6.2%
High Intensity Commercial / Industrial / Transportation	4.0	0.0%	21.0	0.1%	0.0	0.0%	9.0	0.3%	48.0	0.3%
High Intensity Residential	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	11.0	0.1%
Low Intensity Residential	2.0	0.0%	89.0	0.6%	0.0	0.0%	22.0	0.8%	111.0	0.8%
Mixed Forest	3626.0	30.6%	3574.0	22.3%	244.0	30.1%	390.0	14.8%	1291.0	9.2%
Open Water	3.0	0.0%	1.0	0.0%	0.0	0.0%	3.0	0.1%	37.0	0.3%
Other Grasses (Urban / Recreational)	0.0	0.0%	44.0	0.3%	0.0	0.0%	12.0	0.5%	40.0	0.3%
Pasture / Hay	62.0	0.5%	469.0	2.9%	0.0	0.0%	109.0	4.1%	193.0	1.4%
Quarries / Strip Mines / Gravel Pits	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Row Crops	0.0	0.0%	139.0	0.9%	0.0	0.0%	64.0	2.4%	41.0	0.3%
Transitional	0.0	0.0%	3.0	0.0%	0.0	0.0%	2.0	0.1%	119.0	0.8%
Woody Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	11836.0	100.0%	16036.0	100.0%	810.0	100.0%	2627.0	100.0%	14106.0	100.0%

Table B-2 (Cont.) Level IV Ecoregion Reference Site Drainage Area Land Use Distribution

Landuse	Ecosite Subwatershed									
	ECO68C20		ECO71G03		ECO71G04		ECO71G10		ECO71H03	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Deciduous Forest	9931.0	78.7%	6703.0	47.4%	9087.0	53.2%	2726.0	76.5%	6784.0	81.6%
Emergent Herbaceous Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Evergreen Forest	871.0	6.9%	1206.0	8.5%	384.0	2.2%	80.0	2.2%	137.0	1.6%
High Intensity Commercial / Industrial / Transportation	48.0	0.4%	13.0	0.1%	143.0	0.8%	23.0	0.6%	20.0	0.2%
High Intensity Residential	11.0	0.1%	0.0	0.0%	4.0	0.0%	0.0	0.0%	14.0	0.2%
Low Intensity Residential	111.0	0.9%	90.0	0.6%	132.0	0.8%	3.0	0.1%	136.0	1.6%
Mixed Forest	1233.0	9.8%	2635.0	18.6%	1612.0	9.4%	169.0	4.7%	757.0	9.1%
Open Water	37.0	0.3%	2.0	0.0%	3.0	0.0%	0.0	0.0%	0.0	0.0%
Other Grasses (Urban / Recreational)	40.0	0.3%	175.0	1.2%	33.0	0.2%	54.0	1.5%	52.0	0.6%
Pasture / Hay	181.0	1.4%	3138.0	22.2%	4331.0	25.3%	335.0	9.4%	395.0	4.7%
Quarries / Strip Mines / Gravel Pits	0.0	0.0%	0.0	0.0%	42.0	0.2%	0.0	0.0%	0.0	0.0%
Row Crops	38.0	0.3%	184.0	1.3%	1319.0	7.7%	170.0	4.8%	23.0	0.3%
Transitional	116.0	0.9%	0.0	0.0%	0.0	0.0%	5.0	0.1%	0.0	0.0%
Woody Wetlands	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	12617.0	100.0%	14146.0	100.0%	17090.0	100.0%	3565.0	100.0%	8318.0	100.0%

Table B-2 (Cont.) Level IV Ecoregion Reference Site Drainage Area Land Use Distribution

Landuse	Ecosite Subwatershed			
	ECO71H06		ECO71H09	
	[acres]	[%]	[acres]	[%]
Bare Rock/Sand	0.0	0.0%	0.0	0.0%
Deciduous Forest	7788.0	88.7%	6264.0	79.0%
Emergent Herbaceous Wetlands	0.0	0.0%	0.0	0.0%
Evergreen Forest	137.0	1.6%	245.0	3.1%
High Intensity Commercial / Industrial / Transportation	2.0	0.0%	6.0	0.1%
High Intensity Residential	0.0	0.0%	0.0	0.0%
Low Intensity Residential	2.0	0.0%	36.0	0.5%
Mixed Forest	604.0	6.9%	722.0	9.1%
Open Water	1.0	0.0%	0.0	0.0%
Other Grasses (Urban / Recreational)	0.0	0.0%	0.0	0.0%
Pasture / Hay	193.0	2.2%	494.0	6.2%
Quarries / Strip Mines / Gravel Pits	0.0	0.0%	0.0	0.0%
Row Crops	50.0	0.6%	167.0	2.1%
Transitional	1.0	0.0%	0.0	0.0%
Woody Wetlands	0.0	0.0%	0.0	0.0%
Total	8778.0	100.0%	7934.0	100.0%

APPENDIX C

Future Sediment TMDL Related Work in EPA Region IV

1.0 Existing Approach

TMDLs are established at levels necessary to attain and maintain the applicable narrative and numerical water quality standards. (See 40 CFR Section 130.7(c)(1).) Most State Water Quality Standards do not include a numerical water quality standard for aquatic life protection due to sediment. The narrative standard is to maintain the biological integrity of the waters of the State.

The TMDL sediment linkage is defined as the cause and effect relationship between the biological integrity, habitat alteration and identified sediment sources.

An analysis of watershed sediment loading can be conducted at various levels of complexity, ranging from a simplistic gross estimate to a dynamic model that captures the detailed runoff from the watershed to the receiving waterbody. The limited amount of data available for the most regional watersheds prevented EPA from presently using a detailed dynamic watershed runoff model. Instead, EPA determined the sediment contributions to the impaired segments based on an average annual load of sediment from the upstream watershed. Comparing this impaired segment's watershed sediment load to an average annual sediment load from a biologically and habitat unimpaired watershed provides the basis for estimating any needed load reductions for the impaired segments.

Watershed-scale loading of sediment in water and sediment are estimated using the Watershed Characterization System (WCS) Sediment Tool. The Arcview based WCS Sediment Tool loading function model, based on the Universal Soil Loss Equation, falls between that of a detailed simulation model, which attempts a mechanistic, time-dependent representation of pollutant load generation and transport, and simple export coefficient models, which do not represent temporal or spatial variability. The WCS Sediment Tool provides a mechanistic, simplified simulation of precipitation-driven runoff and sediment delivery, yet is intended to be applicable without calibration. Sediment load from runoff can be used to estimate pollutant delivery to the receiving waterbody from the watershed. This estimate is based on sediment concentrations in storm water and an estimate of the average annual sediment load ultimately delivered to the receiving waterbody by runoff and erosion.

2.0 Future Work

Region IV is working with the Region IV States, Federal and State agencies and a Technical Advisory Group, to develop better and more technically sound TMDLs procedures for sediment. This ongoing work includes:

2.1 Development of ecoregion sediment loading curves for unimpaired streams

Development of allowable instream ecoregion based sediment concentrations (for various flow conditions;

Given that a major source of sediment in the impaired unstable streams are from eroding channel banks, in-stream loadings will be simulated using the channel-evolution model; and

Develop a more effective and transferable monitoring strategy for evaluating sediment impacts in streams.

2.2 Development of Ecoregion Sediment Loading Curves

Development of ecoregion sediment loading curves in EPA Region IV will require the establishment of the link between geomorphic, sediment and biologic characteristics of streams in the Southeast USA. Ongoing work, with the USDA - Agricultural Research Service, National Sedimentation Laboratory entails the review of 282 stream sites in seven Level III ecoregions in EPA Region IV. The tasks involve evaluating those streams that have existing records of flow and sediment transport as measured by other Federal agencies (U.S. Geological Survey and U.S. Department of Agriculture). Field and analytic work will be performed on this existing data to determine “reference” sediment-transport conditions and the likelihood that streams are impacted and/or impaired due to excess sediment.

The output of this work will be the results of the analysis of “reference” sediment-transport conditions and describe a rapid approach that TMDL practitioners can use to determine impairment in streams due to excess sediment.

USDA - Agricultural Research Service, National Sedimentation Laboratory will:

- Conduct rapid geomorphic assessments (RGA’s) and determine stage of channel evolution at the 282 sites in seven Level III ecoregions in EPA Region IV. From the total number of 282 sites, select a minimum of two “reference” and two impacted sites in each ecoregion to perform detailed analysis of flow, sediment transport and aquatic community structure. Sites will be used to evaluate links between stage of channel evolution, sediment indices, and biologic integrity. All sites will be located within the states of EPA Region IV.

- Acquire from USDA and USGS existing historical flow and sediment-transport data for all sites selected in Task A. Evaluate sediment yields at the effective discharge and determine from detailed gage records, the channel stability conditions at the time of historical sediment sampling. Characterize the sediment-transport rate at the effective discharge at all sites.

- Acquire 15-minute discharge data and combine with sediment-transport data to determine the frequency, and duration of sediment transport at the four selected sites in each ecoregion. Develop frequency and duration relations for “reference” and impacted sites and compare with available biologic data to assess potential threshold levels of concentration.

- Acquire all existing historical data that may be available on the stream/reach and collect information on bank-material shear strength, bed-material size and erodibility, channel cross-sections and profiles.

- Assemble all sediment-transport results into data tables and histograms for each ecoregion and compare these values with stage VI “reference conditions.”

2.3 Development of allowable instream ecoregion based sediment concentrations

EPA Region IV is participating on Sediment TMDL Technical Advisory Group sponsored by the Georgia Nature Conservancy and the University of Georgia in Athens. A preliminary recommendation from the group is that a TMDL should be expressed as an annual sediment load and a daily sediment load and concentration. The daily load will depend on flow. If an average flow is used for daily load, then this would represent an upper limit for base-flow or chronic conditions. If sediment rating curve slope is available, a flow and sediment concentration for storm flow conditions can be used to calculate a daily-load upper limit that would represent acute condition. Work is ongoing to refine the proposal and to test the proposal in various ecoregions in Georgia.

2.4 Instream loadings simulated using the channel-evolution model

Given that a major source of sediment in the region's stream is from eroding channel banks, in-stream sediment loads will be simulated using other more complex, process-based models like GSTARS or CONCEPTS. These models require a more robust sediment and flow database in the individual watershed. One useful exercise will be to compare the model outputs from some of the preliminary Phase I TMDLs produced by Region IV via BASINS within the South Fork Broad Watershed (noted above) to other more complex, process-based models.

The EPA ORD work on the Broad River sediment data collection project will be useful to compare with other efforts within the Region to develop sediment TMDLs in the Piedmont, Coastal Plain and Interior Plateau. It will also be useful to compare the results of the ORD project to some of the work currently underway between EPA Region IV and the USDA-ARS, National Sedimentation Laboratory in Oxford, Mississippi.

2.5 Develop a more effective and transferable monitoring strategy for evaluating sediment impacts in streams

Monitoring is a key component of the TMDL process and should be particularly emphasized in the Phased TMDLs because of the uncertainty surrounding their establishment. At a minimum, the monitoring program will have to address the issues of discharge, sediment concentrations and loads, and very importantly, temporal resolution (daily, weekly, monthly, seasonally, yearly). The monitoring plan must incorporate the use of consistent and accurate sampling and analytical procedures.

In EPA Region IV's Science and Ecosystem Support Division (SESD) and Water Management Division (WMD) and EPA's Office of Research and Development (ORD) are working on the refinement and implementation of both habitat and biological assessments and sediment storm water monitoring strategies to gather the data and information necessary to develop the more complex TMDLs. These strategies include the measurement of sediment reaching the stream and instream sediment sources.

APPENDIX D

Tennessee Ecoregion Project

Tennessee Ecoregion Project

Note: Major portions of the following narrative, as well as the data in Table D-1, are excerpted or summarized from *Tennessee Ecoregion Project, 1994-1999* (TDEC, 2000). Detailed information regarding the Tennessee Ecoregion Project can be found in this reference

Several narrative criteria, applicable to siltation/habitat alteration, are established in *State of Tennessee Water Quality Standards, Chapter 1200-4-3 General Water Quality Criteria, October 1999* (TDEC, 1999):

Applicable to all use classifications (Fish & Aquatic Life shown):

> Solids, Floating Materials, and Deposits – There shall be no distinctly visible solids, scum, foam, oily slick, or the formation of slimes, bottom deposits or sludge banks of such size and character that may be detrimental to fish and aquatic life.
>
> Other Pollutants – The waters shall not contain other pollutants that will be detrimental to fish or aquatic life.

Applicable to the Domestic Water Supply, Industrial Water Supply, Fish & Aquatic Life, and Recreation use classifications (Fish & Aquatic Life shown):

> Turbidity or Color – There shall be no turbidity or color in such amounts or of such character that will materially affect fish and aquatic life.

Applicable to the Fish & Aquatic Life use classification:

> Biological Integrity - The waters shall not be modified through the addition of pollutants or through physical alteration to the extent that the diversity and/or productivity of aquatic biota within the receiving waters are substantially decreased or adversely affected, except as allowed under 1200-4-3-.06. The condition of biological communities will be measured by use of metrices suggested in guidance such as Rapid Bioassessment Protocols for Use in Streams and Rivers (EPA/444/4-89-001) or other scientifically defensible methods. Effects to biological populations will be measured by comparisons to upstream conditions or to appropriately selected reference sites in the same ecoregion····.

Terms such as "detrimental to fish & aquatic life" and "materially affect fish & aquatic life" are not defined. A method was needed for comparing the existing conditions found in streams to the "natural" or reference condition in healthy, relatively unimpaired streams. The reference data needed to be from similar geographic areas to avoid inappropriate comparisons. It was important that the chosen approach provide scientific, practical, and defensible background data for the different parts of the state.

In the 1980’s, EPA developed a geographical framework called the ecoregion approach. In this approach, the United States is delineated into 76 different Level III ecoregions based on a similarity in climate, landform, soil, natural vegetation, hydrology and other ecologically relevant variables. Tennessee is divided into eight of these regions. The ecoregion approach was considered to be a reasonable way to determine regionally specific information for use in narrative criteria interpretation and application.

The Tennessee Ecoregion Project was initiated in 1993 and had several long-term objectives:

- Refine Level III ecoregions and delineate Level IV ecoregions (subregions) in Tennessee.
- Locate least impacted and minimally disturbed reference streams in each subregion.
- Determine baseline physical, chemical, and biological conditions in reference streams.
- Explore the use of reference data to assist in the interpretation of existing narrative criteria.

Delineation of Subregion Boundaries

The eight Level III ecoregions comprising Tennessee were too large and diverse to be useful for the establishment of water quality goals. It was therefore necessary to refine and subdivide the ecoregions into smaller, more homogeneous units. Beginning in 1993, the Division of Water Pollution Control (DWPC) arranged for James Omernik and Glenn Griffith of EPA's Corvallis Laboratory to subregionalize and update Tennessee's ecoregions (USEPA, 1997). Experts in many disciplines from 27 state and federal agencies, as well as universities and private organizations, were involved in this process. Maps containing information on bedrock and surface geology, soils, hydrology, physiography, topography, precipitation, land use and vegetation were reviewed. The result was the sub-delineation of Tennessee's eight (Level III) ecoregions into 25 (Level IV) ecological subregions.

Reference Stream Selection

Reference sites were chosen to represent the best attainable conditions for all streams with similar characteristics in each of the 25 subregions. An initial candidate list of 241 streams were evaluated as potential reference sites. A set of guidelines developed by Alabama and Mississippi (1994) were used as the basis for field reconnaissance. Potential sites were rated as to how well they met the following criteria:

- The entire watershed was contained within the subregion.
- The watershed was mostly or completely forested (if forest was the natural vegetation type) or has a typical land use for the subregion The watershed may be contained within a National Forest, State Refuge or other protected area.
- The geologic structure and soil pattern was typical of the region.
- The watershed did not contain a municipality, mining area, permitted discharger or any other obvious potential sources of pollutants, including non-regulated sources.
- The watershed was not heavily impacted by nonpoint source pollution.
- The stream flowed in its natural channel and had not been recently channelized. There were no flow or water level modification structures such as dams, irrigation canals or field drains.

- No power or pipelines crossed upstream of the site.
- The watershed contained few roads.

Initial site evaluations were conducted by experienced field biologists. Abbreviated screenings of the benthic community, focusing on clean water indicator species, were conducted at each potential site. Measurements of dissolved oxygen, pH, conductivity and water temperature were obtained, habitat assessments were conducted, and upstream watershed areas were investigated for potential impacts. During field reconnaissance, an additional 122 sites were added to the original candidate list and 139 sites were dropped due to observable impacts during the initial field reconnaissance, leaving 214 sites left for consideration.

The original goal was to select three final reference sites per subregion. This was determined as the minimal number necessary to generate a statistically valid database. Three streams could not always be located in smaller subregions. A total of 70 candidate reference sites were selected by August 1996 for intensive monitoring.

Intensive Monitoring of Reference Streams

From 1996 to 1999, the reference sites were monitored quarterly for chemicals and bacteria. Chemical sampling generally included the parameters historically sampled by the DWPC in its long-term ambient monitoring network. Macroinvertebrate samples and habitat assessments were conducted biannually in spring and fall. Since 1999, the reference streams have been monitored in accordance with the watershed cycle (each stream is visited every five years). Macroinvertebrate biometric and index scores for the ecoregion reference sites used as targets for the Upper Elk River Watershed sediment TMDL are summarized in Table D-1.

Table D-1 Biometric & Index Scores of Target Ecoregion Reference Sites

Reference Stream ID Code	Collection Method*	Sample Date	Total # of Individuals	Taxa Richness	EPT Taxa Richness	EPT Abundance	% Chironomidae	North Carolina Biotic Index	% Clingers % Cling	% Tolerant Organisms % Tol	Tennessee Stream Condition Index
ECO68A01	SQKICK	5/7/97	167	38	11	13.2	53.3	4.45	44.3	28.3	24
ECO68A01	SQKICK	5/8/98	169	41	10	27.2	50.3	4.01	42.0	13.7	32
ECO68A01	SQKICK	4/12/99	161	43	13	33.5	29.2	4.34	38.5	38.5	30
ECO68A01	SQKICK	9/13/96	200	32	7	20.3	58.1	4.13	34.0	7.6	24
ECO68A01	SQKICK	9/26/97	226	43	12	41.6	35.4	3.86	54.0	7.0	34
ECO68A01	SQKICK	9/17/98	170	37	11	30.0	35.3	4.93	38.2	21.2	26
ECO68A03	SQKICK	5/14/97	169	38	15	39.1	45.6	3.82	34.9	9.3	34
ECO68A03	SQKICK	5/18/98	182	39	13	48.9	30.2	2.93	51.6	8.3	34
ECO68A03	SQKICK	4/12/99	179	42	14	54.7	24.6	3.00	60.3	7.5	42
ECO68A03	SQKICK	9/13/96	217	47	16	47.5	29.0	3.05	61.8	7.6	38
ECO68A03	SQKICK	9/26/97	195	46	20	57.4	24.6	2.79	64.6	11.9	42
ECO68A03	SQKICK	9/17/98	162	36	15	50.0	38.3	3.58	46.9	10.3	36
ECO68A08	SQKICK	6/26/97	196	30	13	36.7	19.9	3.95	68.9	6.3	36
ECO68A08	SQKICK	5/22/98	175	35	14	45.7	18.9	4.05	46.3	18.1	38
ECO68A08	SQKICK	4/26/99	193	46	10	28.5	33.2	4.58	50.3	15.6	30
ECO68A08	SQKICK	9/12/96	200	47	18	32.0	26.5	4.72	64.7	25.6	36
ECO68A08	SQKICK	9/22/97	192	31	11	43.8	28.6	4.57	68.2	4.2	32
ECO68A08	SQKICK	9/2/98	171	29	15	32.7	34.5	4.59	66.7	15.2	32
ECO68A13	SQKICK	5/3/99	173	29	13	39.3	46.2	4.08	22.5	12.4	30
ECO68A20	SQKICK	5/27/97	167	38	11	31.7	46.1	4.04	34.1	10.5	30
ECO68A20	SQKICK	5/4/98	170	36	11	38.2	35.9	3.07	47.1	25.3	34
ECO68A20	SQKICK	4/26/99	169	33	8	32.5	50.3	2.84	20.7	9.3	26
ECO68A20	SQKICK	9/11/96	200	41	14	43.0	35.5	4.08	45.0	5.9	36
ECO68A20	SQKICK	9/30/97	172	31	9	48.8	16.9	4.08	53.5	7.4	32
ECO68A26	SQKICK	5/22/98	185	35	18	57.8	7.0	3.65	58.4	27.9	40

* semiquanitative kick

Table D-1 (Cont.) Biometric & Index Scores of Target Ecoregion Reference Sites

Reference Stream ID Code	Collection Method*	Sample Date	Total # of Individuals	Taxa Richness	EPT Taxa Richness	EPT Abundance	% Chironomidae	North Carolina Biotic Index	% Clingers % Cling	% Tolerant Organisms % Tol	Tennessee Stream Condition Index
ECO68A26	SQKICK	4/26/99	184	28	11	45.1	16.8	3.99	59.8	17.3	36
ECO68A26	SQKICK	9/5/97	219	35	12	49.8	18.7	4.16	60.3	12.7	38
ECO68A26	SQKICK	9/2/98	170	32	18	57.6	10.0	4.14	59.4	11.2	40
ECO68A27	SQKICK	3/30/98	196	37	12	38.8	15.3	3.80	38.3	20.2	36
ECO68A27	SQKICK	4/26/99	178	41	11	39.9	34.3	3.03	43.3	12.1	34
ECO68A28	SQKICK	4/14/98	182	14	4	13.7	2.2	3.90	83.0	81.5	20
ECO68A28	SQKICK	5/3/99	172	33	13	30.8	16.9	3.78	55.8	51.8	28
ECO68C12	SQKICK	6/3/97	158	32	8	38.6	11.4	5.42	22.2	58.8	24
ECO68C13	SQKICK	4/16/97	212	31	9	42.0	8.5	2.50	75.5	11.7	34
ECO68C13	SQKICK	8/23/96	200	26	5	17.3	35.9	3.70	58.5	16.9	28
ECO68C13	SQKICK	9/3/97	183	31	9	28.4	54.6	4.84	53.6	19.1	24
ECO68C15	SQKICK	4/16/97	202	38	12	57.9	17.3	3.23	54.0	9.7	38
ECO68C15	SQKICK	4/14/98	184	23	13	80.4	3.8	2.82	48.4	5.5	34
ECO68C15	SQKICK	4/28/99	170	32	13	75.3	9.4	3.17	44.1	7.0	36
ECO68C15	SQKICK	9/6/96	200	32	8	38.4	29.0	3.92	55.9	16.7	30
ECO68C15	SQKICK	9/3/97	203	31	8	19.2	56.7	5.01	46.3	29.9	22
ECO68C15	SQKICK	8/31/98	186	28	10	27.4	59.1	4.76	50.5	13.0	26
ECO68C20	SQKICK	4/14/98	180	25	9	58.9	6.7	3.85	35.6	21.6	32
ECO68C20	SQKICK	4/28/99	205	33	10	72.7	5.9	4.57	10.2	12.3	30
ECO68C20	SQKICK	8/31/98	186	26	6	41.9	23.7	4.05	49.5	22.5	32
ECO71G03	SQKICK	4/28/1998	226	41	18	41.2	13.7	3.88	57.1	14	40
ECO71G03	SQKICK	6/16/1999	213	35	15	35.7	14.1	4.06	58.2	8.3	36
ECO71G03	SQKICK	9/14/1998	188	29	12	56.9	7.4	4.11	69.1	5.4	38
ECO71G04	SQKICK	4/28/1998	237	36	11	65.8	9.3	3.66	44.7	16	38
ECO71G04	SQKICK	6/16/1999	175	26	9	48.6	9.1	4.28	54.9	9.9	32

* semiquanitative kick

Table D-1 (Cont.) Biometric & Index Scores of Target Ecoregion Reference Sites

Reference Stream ID Code	Collection Method*	Sample Date	Total # of Individuals	Taxa Richness	EPT Taxa Richness	EPT Abundance	% Chironomidae	North Carolina Biotic Index	% Clingers % Cling	% Tolerant Organisms % Tol	Tennessee Stream Condition Index
ECO71G04	SQKICK	9/14/1998	201	33	7	55.7	26.4	4.28	44.3	9.5	32
ECO71G10	SQKICK	5/1/1997	223	36	14	74.9	15.7	3.01	43.5	2.8	36
ECO71G10	SQKICK	4/23/1998	231	32	13	77.5	6.5	2.6	51.9	5.4	36
ECO71G10	SQKICK	6/8/1999	188	29	13	50.5	12.8	4.28	75	31.1	34
ECO71G10	SQKICK	9/30/1996	200	24	9	75.2	3.2	3.7	49.8	4.2	34
ECO71G10	SQKICK	10/10/1997	164	24	9	85.4	4.3	4.53	67.7	1.9	34
ECO71G10	SQKICK	9/8/1998	190	25	11	80.5	6.3	4.07	67.4	3.7	38
ECO71H03	SQKICK	5/6/1997	231	30	12	61.9	6.9	2.43	70.1	3.5	38
ECO71H03	SQKICK	5/4/1998	215	31	14	49.3	1.9	2.15	84.2	5.3	38
ECO71H03	SQKICK	6/2/1999	182	30	11	52.2	22.5	4.35	36.3	13.3	34
ECO71H03	SQKICK	10/14/1996	200	25	12	39.7	2	3.22	75.3	9.9	36
ECO71H03	SQKICK	8/20/1997	186	36	11	43	15.6	4.77	38.7	30.2	34
ECO71H03	SQKICK	9/17/1998	186	29	11	55.9	21.5	4.3	60.8	12.8	38
ECO71H06	SQKICK	5/12/1997	169	29	8	62.7	18.3	3.07	43.2	10.1	34
ECO71H06	SQKICK	4/13/1998	188	20	8	70.7	2.1	2.59	62.2	3.8	34
ECO71H06	SQKICK	6/11/1999	196	33	10	43.4	43.9	5.29	21.4	33.5	26
ECO71H06	SQKICK	10/16/1996	200	30	11	38.5	6.9	3.33	61.5	6.8	36
ECO71H06	SQKICK	8/21/1997	176	27	14	72.2	13.1	3.44	50.6	5.7	38
ECO71H06	SQKICK	8/31/1998	191	22	9	58.1	19.4	4.35	40.8	10.1	32
ECO71H09	SQKICK	4/30/1997	183	21	10	63.9	14.2	3.68	33.9	0.6	32
ECO71H09	SQKICK	4/13/1998	172	15	8	34.3	1.2	5.71	32.6	1.2	24
ECO71H09	SQKICK	6/11/1999	199	28	10	45.2	20.6	5.22	37.2	14.4	29
ECO71H09	SQKICK	10/16/1996	200	26	10	61.6	14.5	5.19	46.2	8	34
ECO71H09	SQKICK	8/19/1997	210	33	15	54.3	12.4	5.11	40.5	6.2	34
ECO71H09	SQKICK	8/31/1998	199	21	10	58.8	9	5.53	34.7	20.1	29

* semiquanitative kick

APPENDIX E

NPDES Permit No. TNR10-0000

General NPDES Permit for Storm Water Discharges Associated With Construction Activity

NPDES Permit No. TNR10-0000
General NPDES Permit for Storm Water Discharges Associated With Construction Activity

Information regarding permitting requirements for construction storm water may be downloaded from the TDEC website at:

http://www.state.tn.us/environment/permits/conststrm.htm

NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* may also be downloaded from the TDEC website at:

http://www.state.tn.us/environment/permits/conststrmrul.pdf

The following is a summary of key provisions of NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity*, that relate directly to implementation of Waste Load Allocations (WLAs) for sediment in impaired waterbodies in the Upper Elk River watershed.

> Tennessee General Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* became effective on July 1, 2000 and is required for construction sites that disturb five acres or more. The permit authorizes storm water discharges from construction activities, storm water discharges from construction support activities, and certain non-storm water discharges associated with construction activities. The permit also covers discharges from construction sites that disturb less than five acres if the Director of the Division of Water Pollution Control has determined that the discharge from the site contributes to, or is likely to contribute to, a violation of a State water quality standard, or is likely to be a significant contributor of pollutants to the waters of the State. Discharges that result in violations of State water quality standards are prohibited. Construction activities are required to be carried out in such a manner to prevent violations of State water quality standards.
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> The permitted construction activity is required to develop, maintain, and implement a site-specific Storm Water Pollution Prevention Plan (SWPPP) to minimize erosion of soil and the discharge of pollutants to waters of the State. At a minimum, the SWPPP must include:

- Description of the site, description of the intended sequence of major activities which disturb soil, estimates of total area of the site and area disturbed, any data describing the soil or the quality of any site discharge, site location, identification of storm water outfalls, identification of receiving waters.

- Description of appropriate control measures and the general timing during the construction process that measures will be implemented. (The permit describes in some detail minimum requirements for: 1) erosion and sediment controls designed to retain sediment on site; 2) stabilization practices for disturbed portions of the site; 3) structural practices to divert flows from exposed soils, store flows, or otherwise limit runoff and pollutant discharge resulting from a 2 year, 24 storm (approximately 3.5 inches/24 hours for the Upper Elk River watershed); and 4) storm water management measures that will be installed after construction operations have been completed).

- Maintenance procedures to ensure that vegetation, erosion, and sediment control measures are kept in good and effective operating condition.

- A schedule of inspections by qualified personnel of disturbed areas of the construction site that are not fully stabilized, storage areas exposed to precipitation, structural control measures, outfall points, and locations where vehicles enter and exit the site. These inspections must be performed before certain anticipated storm events, within 24 hours after storm events of 0.5 inches , or greater, and at least once every two weeks (once per week for receiving streams listed on the 303(d) list for siltation). Based on the results of inspections, inadequate or damaged control measures must be modified or repaired as necessary before the next anticipated storm event (within seven days maximum). Also based on the results of inspections, pollution prevention measures must be revised as necessary within a specified time frame. Inspections must be documented.

- Sources of authorized non-storm water that are combined with storm water discharges associated with construction activity must be identified in the plan and appropriate pollution prevention measures for the non-storm water component of the discharge identified and implemented.

<u>Additional requirements are specified for discharges into waters listed on the Tennessee 303(d) list for siltation</u>. These additional requirements include:

- The SWPPP must be submitted to the local Environmental Assistance Center (EAC) prior to the start of construction.

- More frequent (weekly) inspections of erosion and sediment controls. Inspections and the condition of erosion and sediment controls must be certified to TDEC on a weekly basis.

- If TDEC learns that a discharge is causing a violation of water quality standards or contributing to the impairment of a 303(d) listed water, the discharger will be notified that the discharge is no longer eligible for coverage under the general permit and that additional discharges must be covered under an individual permit.